Elements of Reasoning
The Three Dimensions of Critical Thinking

- Critical Thinking
  - Analysis of thinking by focusing on the parts
  - Evaluation of thinking by focusing on the standards
  - Improvement of thinking by using what you learned
The Underlying Principles of Critical Thinking

The Standards
- clarity
- precision
- accuracy
- significance
- relevance
- completeness
- logical
- fairness
- breadth
- depth

must be applied to

The Elements
- purposes
- inferences
- questions
- concepts
- points of view
- implications
- information
- assumptions

as we develop

Intellectual Traits
- intellectual humility
- intellectual perseverance
- intellectual autonomy
- intellectual integrity
- confidence in reasoning
- intellectual courage
- intellectual empathy
- Fair-mindedness
Elements of Reasoning

Reasoning: The process of drawing conclusions or figuring something out

Traits of the Disciplined Mind

Standards for Reasoning
What is involved in analyzing reasoning?
(Story, argument, point of view, subject)

In other words, what elements must you account for in order for the analysis to be substantive?
Whenever we think

We think for a purpose

within a point of view based on assumptions leading to implications and consequences.

We use data, facts, and experiences

to make inferences and judgments

based on concepts and theories in attempting to answer a question.
A CRITICAL THINKER

Considers the Elements of Thought

Points of View
- Frame of Reference
- Perspective
- Orientation

Purpose of the Thinking
- Goal, objective

Implications & Consequences

Questions at Issue
- Problem

Information
- Data, observations, facts, experiences

Assumptions
- Presuppositions, taking for granted

Concepts
- Theories, laws, models, definitions, principles

Interpretation & Inference
- Conclusions, solutions
We must routinely take our thinking apart.
Elements of Reasoning

- Study for approx. 5 minutes in order to teach your pages to one another.
- When teaching, notes can be used to teach, but not the guide.
Teaching Elements

- Join groups together to form groups of 4. Persons A, B, C, D. The goal in this activity is for you to learn the elements of reasoning more deeply. You will study, in order to teach, the following pages (Analytic Guide):
Person A will focus on **Purpose**, (pp. 14, 42), and **Assumptions** (pp. 18, 46)

Person B will focus on **Question**, (pp. 15, 43), and **Concepts**, (pp. 19, 47)

Person C will focus on **Information** (pp. 16, 44), and **Point of View**, (pp. 20, 48)

Person D will focus on **Inference**, (pp. 17, 45), and **Implications**, (pp. 21, 49)
You will have 12 minutes to study all pages in order to teach your concepts to your group. After six minutes, I will signal you to move to your second concept in preparing, if you haven’t already.
Check for Understanding

In the next phase of this activity, before you begin to teach, you will join together with the people who studied the same concepts you studied. This is an important part of the study process. It will help correct for mistakes in understanding as well as deepen your understanding of the concepts you will be teaching. Persons A join together in one group, Persons B, Persons C, and Persons D in other groups. If you have more than 5 people per group, split into additional groups, so you may have several “Person A” groups, etc.
Teach to Your Group

- Go back to your original groups of 4 for the teaching process.

- Each person will have 3 minutes to teach each of your elements to their group.

- If you run out of things to say in your 3 minutes, see if you can answer any questions from your group. Person A will begin with *Purpose*. At the end of 3 minutes, you will hear the tone. Stop immediately, even if in mid-sentence, and Person B then teaches *Question* for three minutes. Keep going around the table in this way moving through all of the eight elements in this order. Move to the next person, and therefore the next concept every time you hear the tone.
Teach in this order:

- Purpose
- Questions
- Information
- Inference
- Assumptions
- Concepts
- Point of View
- Implications
Unconscious Level of Thinking

Information (situation) → Inference (conclusion) → Assumption

Unconscious Level of Thinking
<table>
<thead>
<tr>
<th>Information (situation)</th>
<th>Inference</th>
<th>Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. You see a man with a black eye</td>
<td>He has been hit by someone</td>
<td>People who have black eyes have been hit</td>
</tr>
<tr>
<td>2. A police officer trails your car for several blocks</td>
<td>He is trying to catch me breaking the law</td>
<td>Anytime a police officer trails you he is trying to catch you breaking the law</td>
</tr>
<tr>
<td>3. During class, a student asks “is this going to be on the test?”</td>
<td>This student is not interested in learning the subject</td>
<td>Students who ask questions like: “Is this going to be on the test?” are not interested in learning the subject</td>
</tr>
<tr>
<td>4. You see a child crying next to her mother in a grocery store</td>
<td>The mother has hurt the child</td>
<td>Whenever a child is crying next to her mother she has been hurt by her mother</td>
</tr>
<tr>
<td>5. You see a man in tattered clothes sitting on a curb with a paper bag in his hand</td>
<td>He must be a bum</td>
<td>All men in tattered clothes sitting on curbs with paper bags in their hands are bums</td>
</tr>
<tr>
<td>Information</td>
<td>Inference</td>
<td>Assumption</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>1. Your teenage son is late coming home from a late night date</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Your spouse is late coming home from work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. You meet a beautiful woman with blond hair</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. You get an ‘A’ on a history test.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Your spouse is talking to a member of the opposite sex at a late night party</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A critical thinker considers the elements of reasoning:

- **Points of View**: frame of reference, perspective, orientation
- **Purpose of the Thinking**: goal, objective
- **Implications & Consequences**
- **Question at Issue**: problem
- **Assumptions**: presupposition, taking for granted
- **Information**: data, facts, observations, experiences
- **Concepts**: theories, definitions, axioms, laws, principles, models
- **Interpretation & Inference**: conclusions, solutions

**With Sensitivity to Universal Intellectual Standards**

- Clear
- Accurate
- Deep
- Precise
- Relevant
- Breadth
Eight Questions Students Can Routinely Ask When They Understand the Elements of Reasoning

1. What is the main **purpose** of the reasoning?
2. What are the key **issues, problems, and questions** being addressed?
3. What is the most important **information** being used?
4. What main **inferences** are embedded in the reasoning?
5. What are the key **concepts** guiding the reasoning?
6. What **assumptions** are being used?
7. What are the positive and negative **implications**?
8. What **point of view** is/should be represented?
Eight Questions Students Can Ask to Figure out the Logic of a Character in a Story

1. What is the main **purpose** of the character?
2. What are the key **issues and problems** facing the character?
3. What is the most significant **information** the character uses in his or her reasoning?
4. What main **inferences** or judgments are made by the character?
5. What key **concepts** guide the character’s reasoning?
6. What main **assumptions** guide the behavior of the character?
7. What are the most important **implications** of the character’s thinking and behavior?
8. What is the main **point of view** of the character? Does that point of view change during the story? If so, how?
Eight Questions Students Can Ask to Figure out the Logic of a Subject or Discipline:

1. What is the main **purpose** of the subject?
2. What are the key **issues, problems, and questions** addressed within the subject?
3. What kinds of **information** are pursued within the discipline?
4. What types of **inferences** or judgments are made?
5. What key **concepts** inform the discipline?
6. What key **assumptions** underlie the discipline?
7. What are some important **implications** of studying the discipline?
8. What **points of view** are fostered within the discipline?
Questions Targeting the Elements of Thought in a Writing a Paper

**Purpose:** What am I trying to accomplish? What is my central aim or goal?

**Information:** What information am I using in coming to that conclusion? What experience have I had to support this claim? What information do I need to settle the question?

**Inferences/Conclusions:** How did I reach this conclusion? Is there another way to interpret the information?

**Concepts:** What is the main idea here? Could I explain this idea?

**Assumptions:** What am I taking for granted? What assumption has led me to that conclusion?

**Implications/Consequences:** If someone accepted my position, what would implications? What am I implying?

**Points of View:** From what point of view am I looking at this issue? Is there another point of view I should consider?

**Questions:** What question am I raising? What question am I addressing?
The Underlying Principles of Critical Thinking

The Standards
- clarity precision
- accuracy significance
- relevance completeness
- logical fairness
- breadth depth

must be applied to

The Elements
- purposes inferences
- questions concepts
- points of view implications
- information assumptions

as we develop

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Activity One:
Taking Initial Ownership of the Elements

pp. 4-5 in the *Miniature Guide to Critical Thinking*. In pairs, one person will explain the odd numbered elements, the other, the even numbered. Read the first sentence to your partner, then explain the element in your own words.

Then read aloud the criteria listed for assessing reasoning using the elements. Then move to the next element. Notice which elements you are the most comfortable in explaining and which you find more difficult.
Elements of Reasoning: Constructing Initial Understandings

- Work in pairs. Person A. Person B.
- Use Analytic Thinking Guide.
- Person A will study p. 10 to teach the content to your partner.
- Person B will study p. 11 to teach it to your partner.
- Take notes. Use notes to teach.
Working in pairs

- Silently read the following pages: 18, 19, 20, 31, 32, 33
- Then discuss your understanding of these pages and their significance to instruction.
Take your understanding of the elements of reasoning to the next level

- Work in pairs.
- Each person draws two circles
- Using your best thinking, fill in your two circles with as much detail as possible:
  - a. One circle includes the main points about the elements.
  - b. One circle has questions you can ask when you understand the elements.
  - c. Then add some intellectual standards to the first circle.
Elements of Reasoning

Working in pairs, draw the elements of reasoning circle.

Define each Element. Then fill the circle with as much detail as you can.
Add the Standards

Now add the intellectual standards to your wheel. Which ones relate to which elements? Add to the outside of your circle.
Elements of Reasoning Questions

Draw another circle, and fill it in with questions you can ask when you understand the elements of reasoning and are using them explicitly in your thinking.
The Logic of an Experiment

(Attach a detailed description of the experiment or laboratory procedure.)

The main goal of the experiment is...

The hypothesis(es) we seek to test in this experiment is(are)...

The key question the experiment seeks to answer is...

The controls involved in this experiment are...

The key concept(s) or theory(ies) behind the experiment is(are)...

The experiment is based on the following assumptions...

The data that will be collected in the experiment are...

The potential implications of the experiment are...

The point of view behind the experiment is...
The Logic of Ecology

**Goals of Ecologists:** Ecologists seek to understand plants and animals as they exist in nature, with emphasis on their interrelationships, interdependence, and interactions with the environment. They work to understand all the influences that combine to produce and modify an animal or given plant, and thus to account for its existence and peculiarities within its habitat.

**Questions that Ecologists Ask:** How do plants and animals interact? How do animals interact with each other? How do plants and animals depend on one another? How do the varying ecosystems function within themselves? How do they interact with other ecosystems? How are plants and animals affected by environmental influences? How do animals and plants grow, develop, die, and replace themselves? How do plants and animals create balances between each other? What happens when plants and animals become unbalanced?
**Information that Ecologists Use:** The primary information used by ecologists is gained through observing plants and animals themselves, their interactions, and how they live within their environments. Ecologists note how animals and plants are born, how they reproduce, how they die, how they evolve, and how they are affected by environmental changes. They also use information from other disciplines including chemistry, meteorology and geology.

**Judgments that Ecologists Make:** Ecologists make judgments about how ecosystems naturally function, about how animals and plants within them function, about why they function as they do. They make judgments about how ecosystems become out of balance and what can be done to bring them back into balance. They make judgments about how natural communities should be grouped and classified.
Concepts that Guide Ecologists’ Thinking: One of the most fundamental concepts in ecology is **ecosystem**, defined as a group of living things that are dependent on one another and living in a particular habitat. Ecologists study how differing ecosystems function. Another key concept in ecology is **ecological succession**, the natural pattern of change occurring within every ecosystem when natural processes are undisturbed. This pattern includes the birth, development, death, and then replacement of natural communities. Ecologists have grouped communities into larger units called biomes, regions throughout the world classified according to physical features, including temperature, rainfall and type of vegetation. Another fundamental concept in ecology is **balance of nature**, the natural process of birth, reproduction, eating and being eaten, which keeps animal/plant communities fairly stable. Other key concepts include imbalances, energy, nutrients, population growth, diversity, habitat, competition, predation, parasitism, adaptation, coevolution, succession and climax communities and conservation.
Key Assumptions that Ecologists Make: Patterns exist within animal/plant communities; these communities should be studied and classified; animals and plants often depend on one another and modify one another; and balances must be maintained within ecosystems.

Implications of Ecology: The study of ecology leads to numerous implications for life on Earth. By studying balance of nature, for example, we can see when nature is out of balance, as in the current population explosion. We can see how pesticides, designed to kill pests on farm crops, also lead to the harm of mammals and birds, either directly or indirectly through food webs. We can also learn how over-farming causes erosion and depletion of soil nutrients.

Point of View of Ecologists: Ecologists look at plants and animals and see them functioning in relationship with one another within their habitats, and needing to be in balance for the earth to be healthy and sustainable.
Activity Two: Beginning to Figure Out the Logic of Education

Using your beginning understanding of the elements of reasoning, take turns completing these statements.

The purpose of education is…

The main problem(s) we face in educating our students is/are…

If we truly educate students, some of the important implications are…
Activity Three: Beginning to Figure Out the Logic of a Subject or Discipline

Using your beginning understanding of the elements of reasoning, take turns completing these statements.

The purpose of the discipline is…

Some of the main questions pursued within the discipline are…

Some of the important implications of studying the discipline are…
SEEI Strategy

- (State) To me this means...
- (Elaborate) In other words...
- (Give example from real life) To exemplify...
- (Give an analogy to improve understanding) To illustrate...
Process

- What important insights did you gain through doing these activities – insights about the elements of reasoning?

- How might you better foster use and understanding of the elements of reasoning in your classes?

Refer to pp. 22-23, 24-27, 28, 29, 30
<table>
<thead>
<tr>
<th>Elements of reasoning</th>
<th>intellectual standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>clarity</td>
</tr>
<tr>
<td>Question</td>
<td>accuracy</td>
</tr>
<tr>
<td>Information</td>
<td>precision</td>
</tr>
<tr>
<td>Inference</td>
<td>relevance</td>
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<td>Assumption</td>
<td>logicalness</td>
</tr>
<tr>
<td>Concepts</td>
<td>depth</td>
</tr>
<tr>
<td>Implications</td>
<td>breadth</td>
</tr>
<tr>
<td>Point of view</td>
<td>significance</td>
</tr>
<tr>
<td>Egocentricity, dominating ego</td>
<td>fairness</td>
</tr>
<tr>
<td>Sociocentricity</td>
<td></td>
</tr>
<tr>
<td>Intellectual virtues</td>
<td></td>
</tr>
</tbody>
</table>
Gerald’s diagram

What is Critical Thinking?

Figure 1.3  The process of critical thinking in a discipline.

You can picture the discipline as a lens or set of lenses through which people reason. Figure 1.3 gives us a full picture.
The elements are the result of the analysis of the obvious.
HE MUST BE YOURS.
"This formula is like the Constitution. You can't interpret it unless you know my intent."
HMS Daedalus Incident

The second foreign vessel to drop anchor in Waimea was the HMS Daedalus, a shore ship of Captain George Vancouver. It was on May 11, 1792, that the Daedalus sent out a party of eight men to locate a supply of fresh water in the valley. Only five men returned to the ship.
An account from a native present said that a dispute arose at the watering place between the Hawaiians and the men of the Daedalus. The reason for the attach is not clear, but a Portuguese seaman was killed and two officers, Lieutenant Hergist, and astronomer, Mr. Gooch, were carried off and killed.
Six Hawaiians were later punished with death as a result of their attack on these British seamen.

This tragedy resulted from a misunderstanding between two cultures.