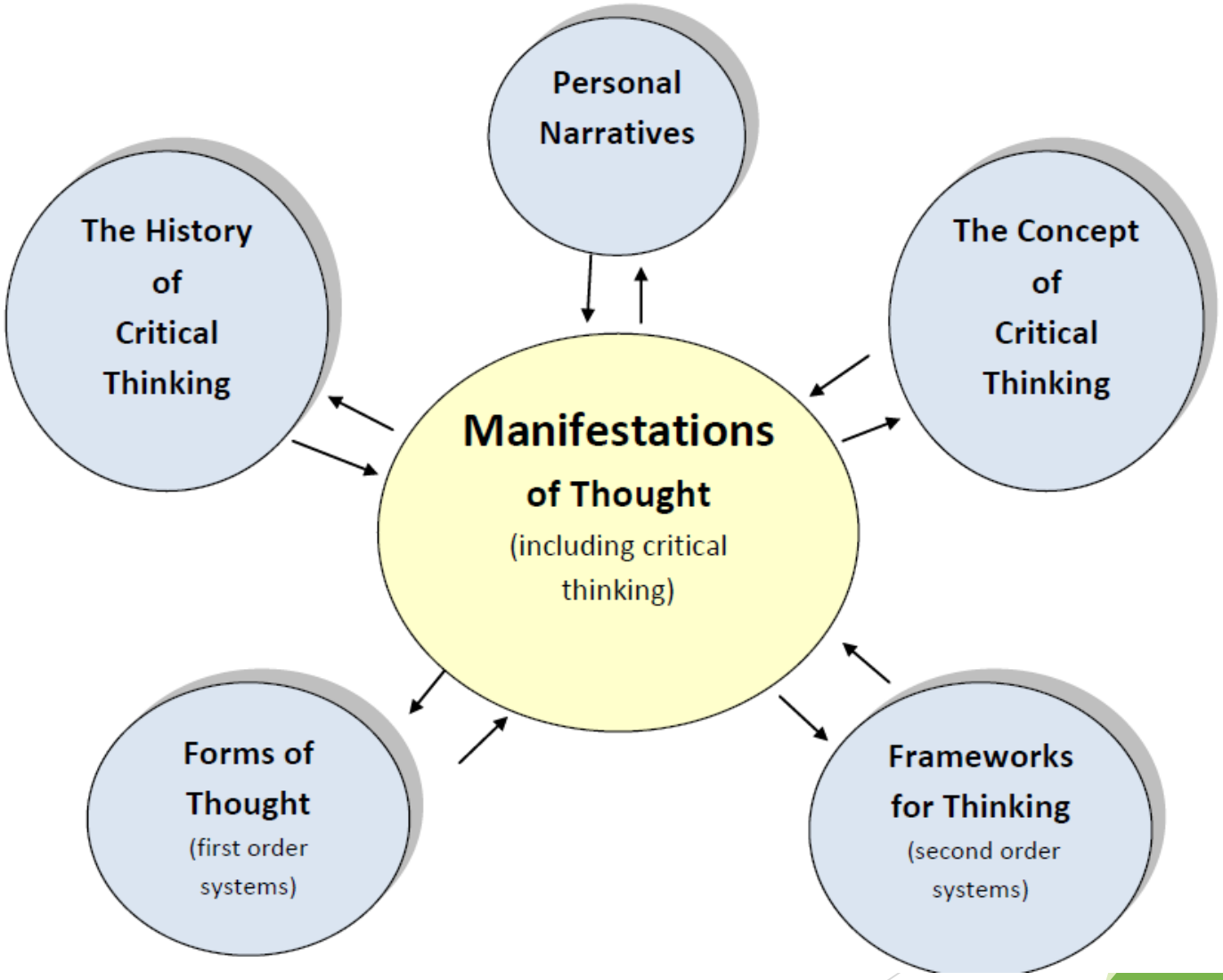
Critical Thinking & Problem Solving

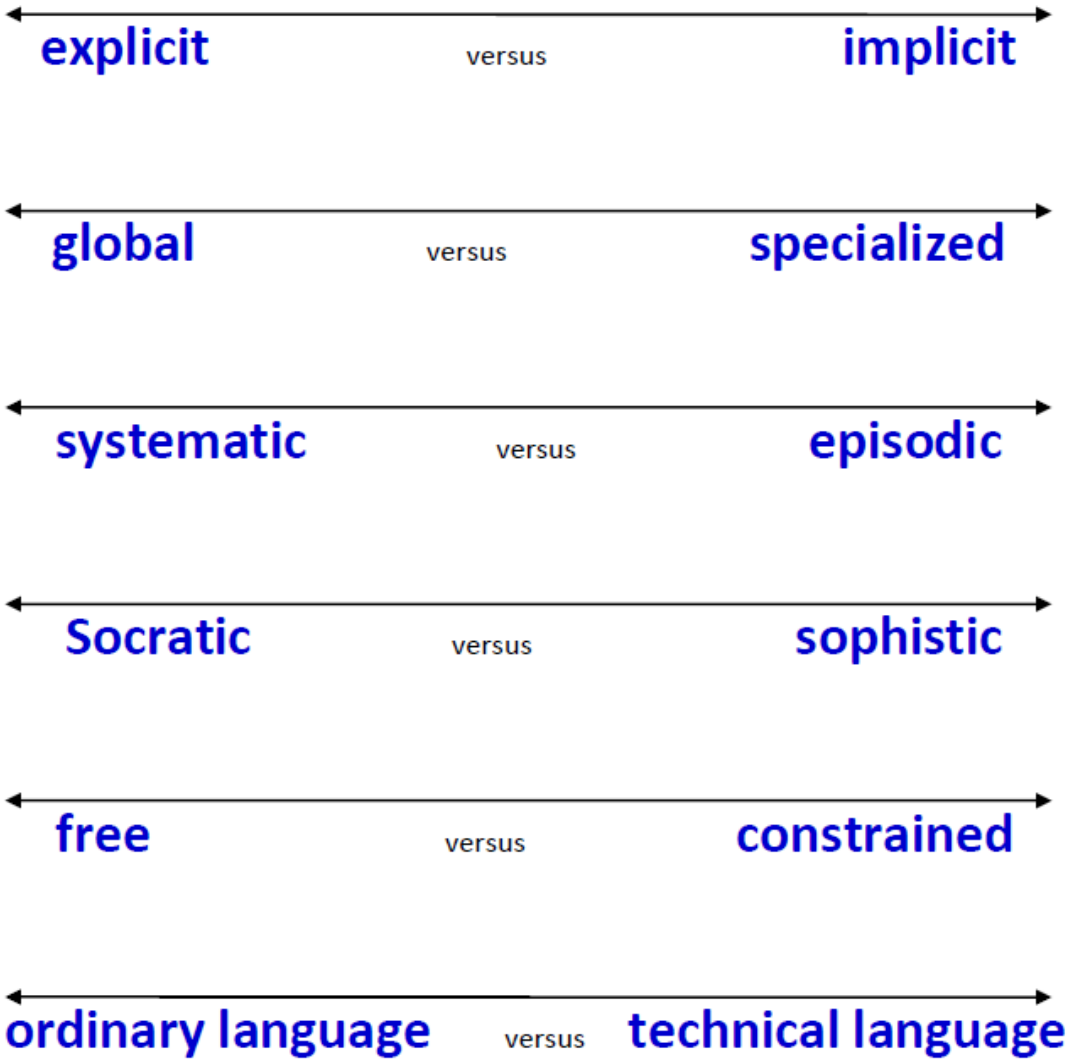
Dr.Bektash Berdiev

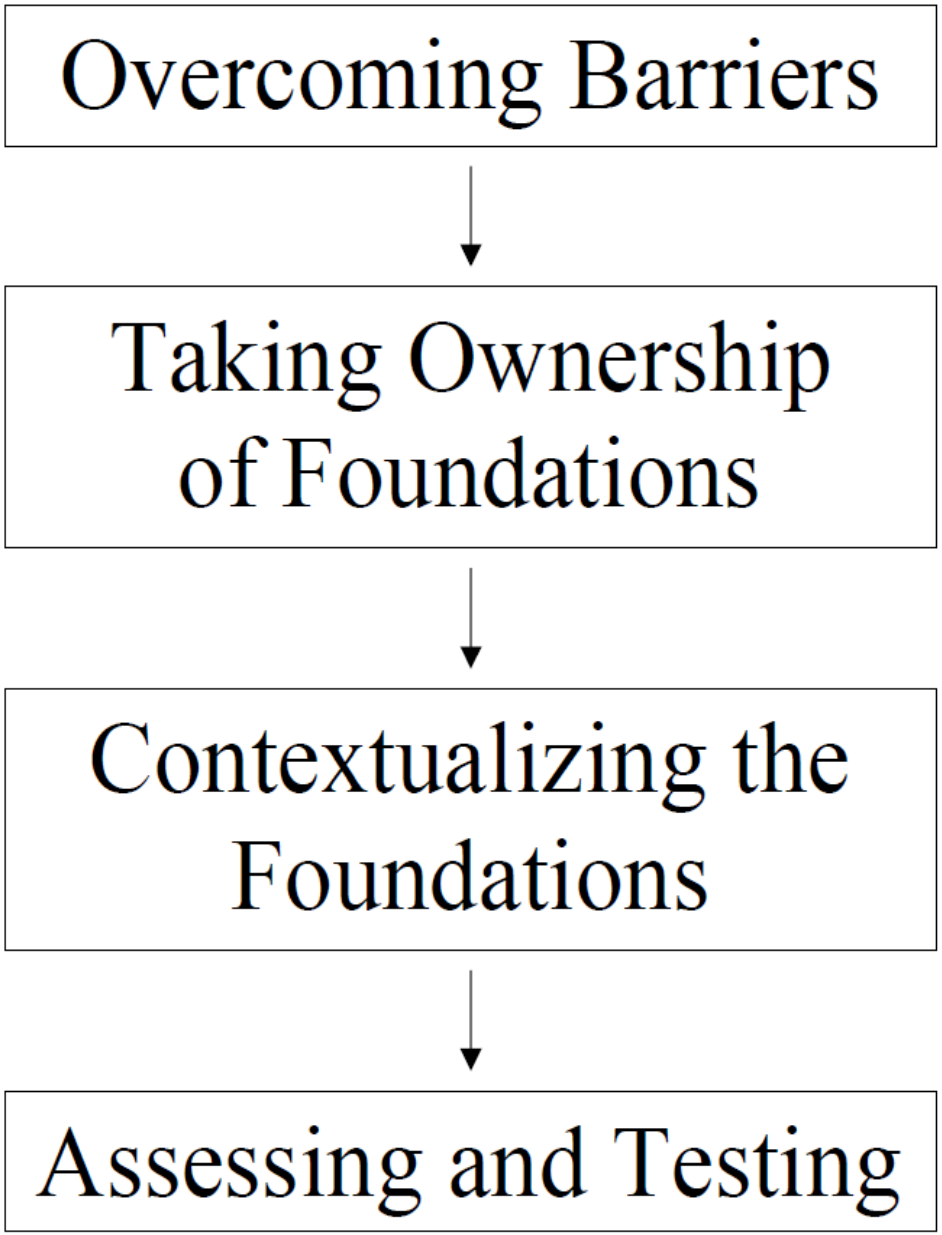
Several Traits of Critical Thinkers you Should Imitate

Critical Thinking: A Map of the Field

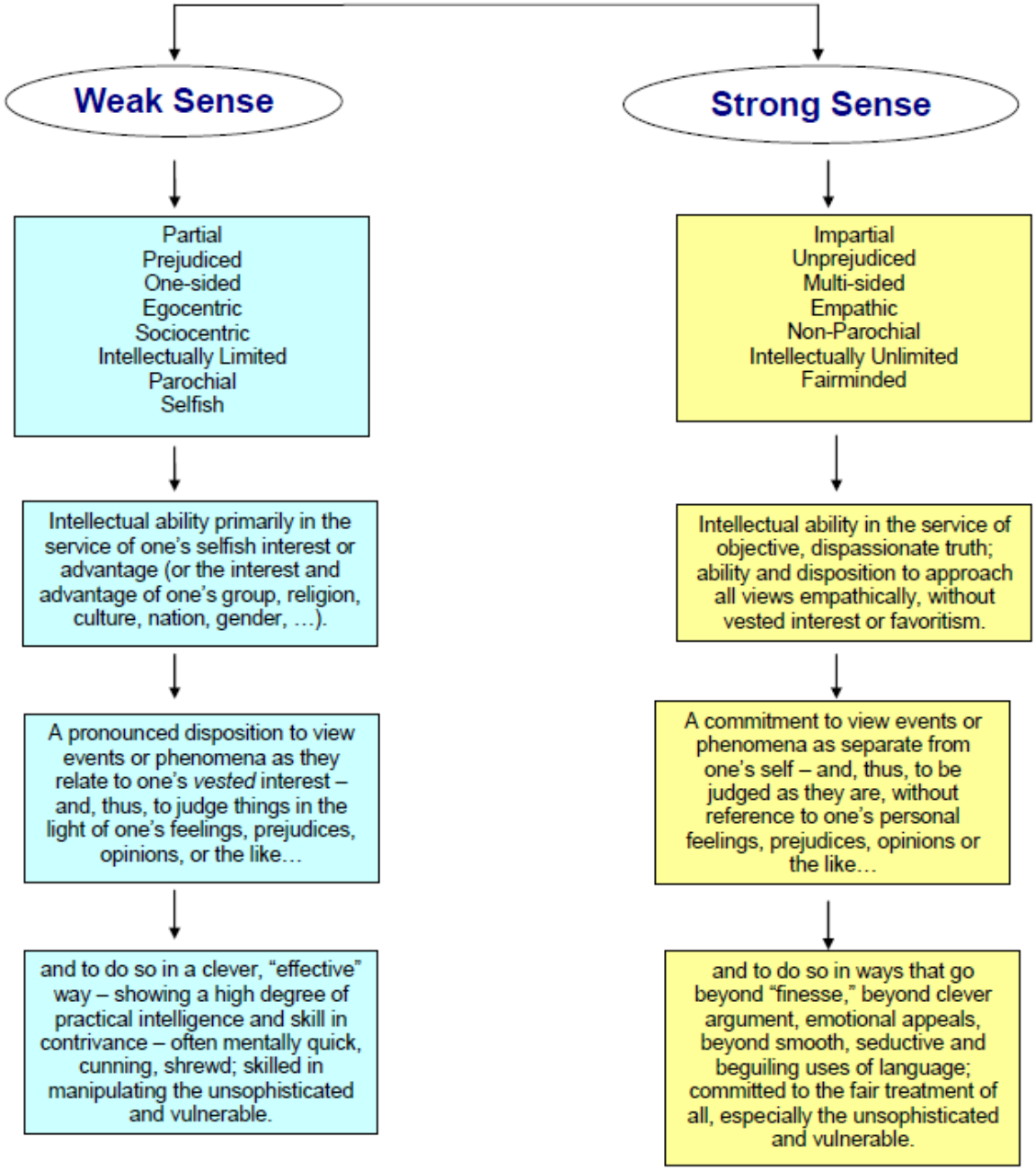


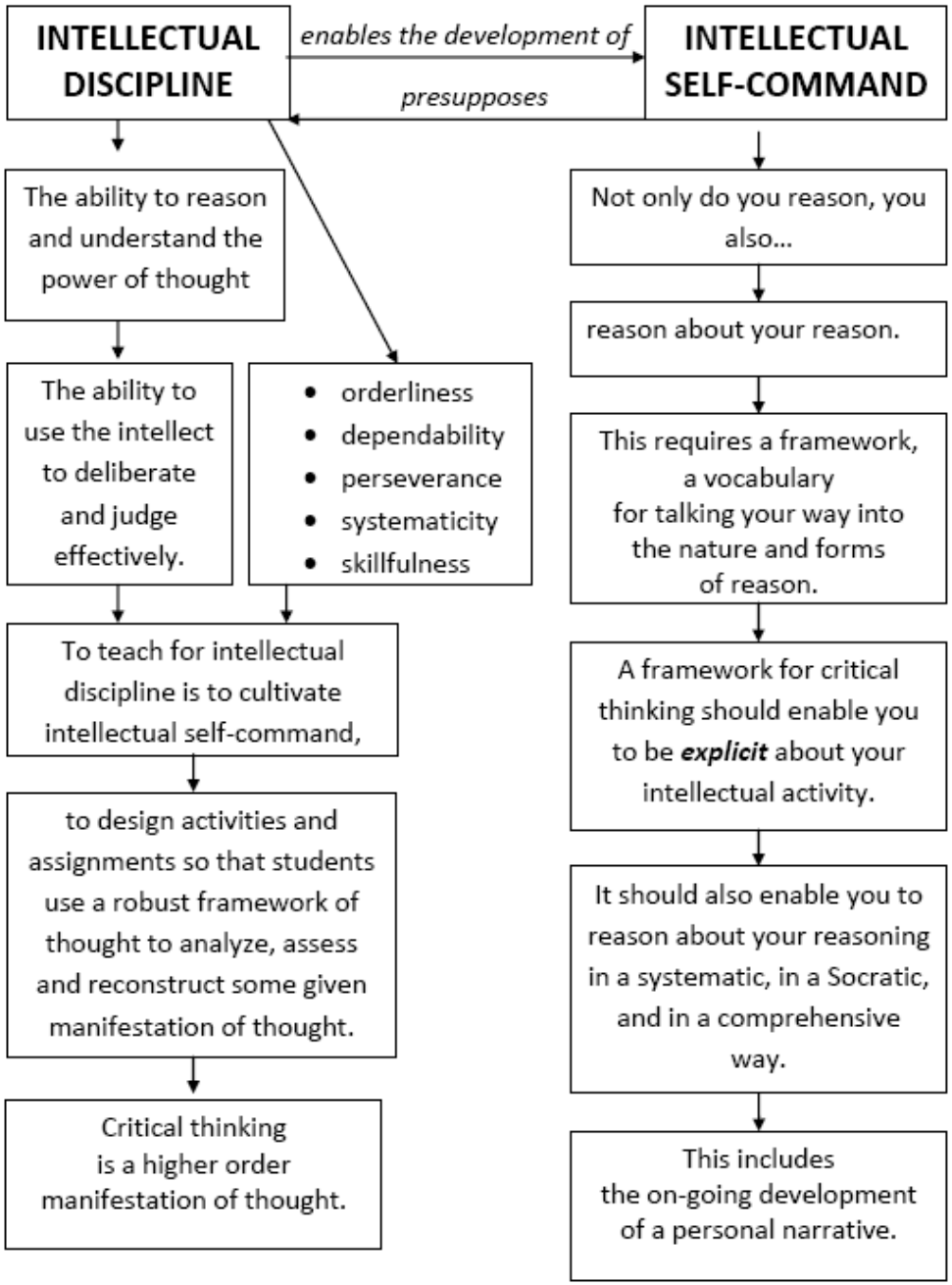
Assessing Frameworks for Thinking Using Six Polarities




Overcoming Barriers
Taking Ownership of Foundations
Contextualizing the Foundations
Assessing and Testing

Critical Thinking

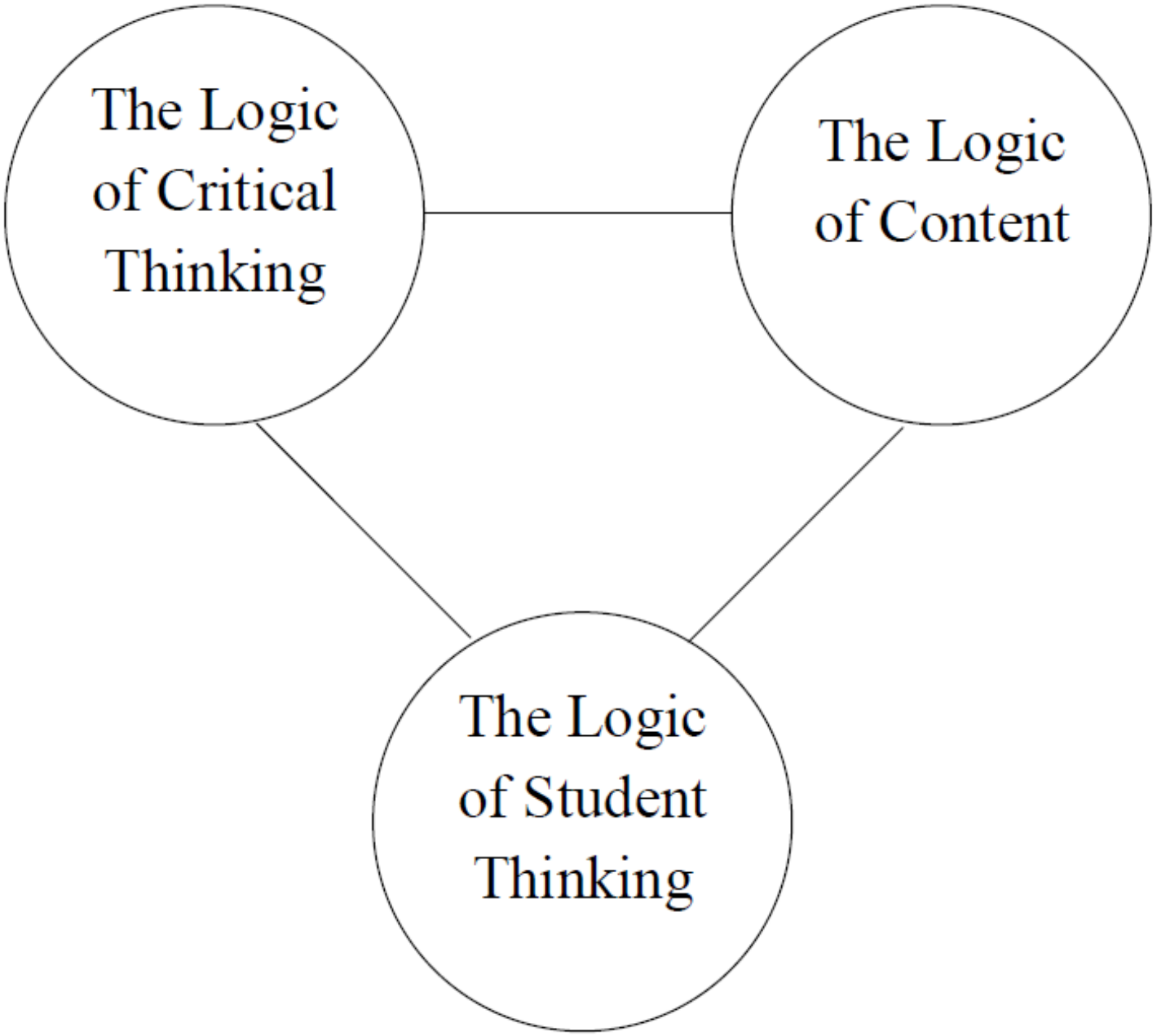



INTELLECTUAL DISCIPLINE
enables the development of
presupposes
INTELLECTUAL SELF-COMMAND
The ability to reason and understand the power of thought
The ability to use the intellect to deliberate and judge effectively.
orderliness
dependability
perseverance
systematicity
skillfulness
To teach for intellectual discipline is to cultivate intellectual self-command,
to design activities and assignments so that students use a robust framework of thought to analyze, assess and reconstruct some given manifestation of thought.
Critical thinking is a higher order manifestation of thought.
Not only do you reason, you also...
reason about your reason.
This requires a framework, a vocabulary for talking your way into the nature and forms of reason.
A framework for critical thinking should enable you to be explicit about your intellectual activity.
It should also enable you to reason about your reasoning in a systematic, in a Socratic, and in a comprehensive way.
This includes the on-going development of a personal narrative.

Thinking Within Every Subject and Domain of Human Thought

Anthropological thinking
Mathematical thinking
Sociological thinking
Historical thinking
Archeological thinking
Biological thinking
Botanical thinking
Zoological thinking
Chemical thinking
Biochemical thinking
Geological thinking
Political thinking
Geographical thinking
Ecological thinking
Physiological thinking
Astronomical thinking
Financial thinking
Medical thinking
Pharmacological thinking
Psychological thinking
Arithmetic thinking
Algebraic thinking
Geometrical thinking
Musical thinking
Artistic thinking
Biotechnological thinking
Criminological thinking
Epidemiological thinking
Statistical thinking
Technological thinking
Nano-technological thinking
Global thinking
Philosophical thinking
Metaphysical thinking
_____ thinking

Thinking like a doctor
Thinking homeopathically
Thinking allopathically
Thinking like a surgeon
Thinking like a psychologist
Thinking like an economist
Thinking like a librarian
Thinking like a lawyer
Thinking like an educator
Thinking like a teacher
Thinking like a principal
Thinking like a dean
Thinking like a classroom teacher
Thinking like a novelist
Thinking like a dramatist
Thinking like a poet
Thinking like a writer
Thinking like a civil engineer
Thinking like a nurse
Thinking like an accountant
Thinking like an architect
Thinking like a sculpture
Thinking like a painter
Thinking like a dancer
Thinking like a physicist
Thinking like a parasitologist
Thinking like a linguist
Thinking like a computer scientist
Thinking like a judge
Thinking like a defense attorney
Thinking like a prosecutor
Thinking like a police officer
Thinking like a social worker
Thinking like a physical therapist
Thinking like a _____


The Logic of Critical Thinking
The Logic of Content
The Logic of Student Thinking

Critical thinking is foundational to the effective teaching of any subject.

Critical thinking, deeply understood, provides a rich set of concepts that enable us to think our way through any subject or discipline, through any problem or issue.

A substantive concept of critical thinking is one that has a significant array of implications for teaching and learning.

A substantive concept of critical thinking implies that:

Content is a product of thinking and can be learned only through thinking.

All subjects exist only as modes of thinking.

The only way to learn a subject is to construct the ideas in the subject in one's thinking using one's thinking.

There are essential structures in all reasoning within all subjects (that enable us to understand those subjects).

There are intellectual standards that must be used to assess reasoning within all subjects.

There are traits of mind that must be fostered if one is to become a disciplined thinker, able to reason well within multiple, and even conflicting, viewpoints.

What is the relationship between content and thinking?

Believe me, I would very much like to foster critical thinking, but I have too much content to cover!

Content

=

Thinking

Content is:

- Understood by thinking
- Constructed by thinking
- Modified by thinking
- Applied by thinking
- Questioned by thinking
- Assessed by thinking

The only way to understand any content is through thinking

Robert Reich, former secretary of labor,

identifies four components of the kind of thinking that highly paid workers will increasingly need to master:

1. Command of abstractions
2. Ability to think within systems
3. Ability to evaluate ideas
4. Ability to communicate effectively

Donald Kennedy, Past President of Stanford, in a letter sent to 3000 college and university presidents.

It simply will not do for our schools to produce a small elite to power our scientific establishment and a larger cadre of workers with basic skills to do routine work. Millions of people around the world now have these same basic skills and are willing to work twice as long for as little as 1/10th our basic wages…We must develop a leading-edge economy based on workers who can think for a living. If skills are equal, in the long run wages will be too. This means we have to educate a vast mass of people capable of thinking critically, creatively, and imaginatively.

Studies of higher education demonstrate three disturbing, but hardly novel, facts:

1. Most college faculty at all levels lack a substantive concept of critical thinking.

2. Most college faculty don't realize that they lack a substantive concept of critical thinking, believe that they sufficiently understand it, and assume they are already teaching students it.

3. Lecture, rote memorization, and (largely ineffective) short-term study habits are still the norm in college instruction and learning today.

These three facts, taken together, represent serious obstacles to essential, long-term institutional change,

for only when administrative and faculty leaders grasp the nature, implications, and power of a robust concept of critical thinking---as well as gain insight into the negative implications of its absence---are they able to orchestrate effective professional development.

When faculty have a vague notion of critical thinking,

or reduce it to a single-discipline model (as in teaching critical thinking through a “logic” or a “study skills” paradigm),

it impedes their ability to identify ineffective, or develop more effective, teaching practices.

It prevents them from making the essential connections (both within subjects and across them), connections that give order and substance to teaching and learning.

Critical thinking is essential to the effective teaching of any subject. When critical thinking is deeply understood, it provides a rich set of concepts that enable us to think our way through any subject or discipline, through any problem or issue.

Research

Lion Gardiner

Redesigning Higher Education: Producing Dramatic Gains in Student Learning

In conjunction with:

ERIC Clearinghouse on Higher Education

Meta-analysis of the literature on teaching effectiveness in higher education

1995

Key Question in the Study

Critical reports by authorities on higher education, political leaders and business people have claimed that higher education is failing to respond to the needs of students, and that many of our graduates' knowledge and skills do not meet society's requirements for well-educated citizens.

How valid are these claims?

In other words, how effectively are we educating our students?

Main Conclusions of the Study

"Faculty aspire to develop students' thinking skills, but research consistently shows that in practice we tend to aim at facts and concepts in the disciplines, at the lowest cognitive levels, rather than development of intellect or values."

"Numerous studies of college classrooms reveal that, rather than actively involving our students in learning, we lecture, even though lectures are not nearly as effective as other means for developing cognitive skills.

"Studies suggest our methods often *fail* to dislodge students' misconceptions and ensure learning of complex, abstract concepts. Capacity for problem solving is limited by our use of inappropriately simple practice exercises."

"Classroom tests often set the standard for students' learning. As with instruction, however, we tend to emphasize recall of memorized factual information rather than intellectual challenge.

Taken together with our preference for lecturing, our tests may be reinforcing our students' commonly fact-oriented memory learning, of limited value to either them or society."

"Faculty agree almost universally that the development of students' higher-order intellectual or cognitive abilities is the most important educational task of colleges and universities.

These abilities underpin our students' perceptions of the world and the consequent decisions they make."

"Specifically, critical thinking – the capacity to evaluate skillfully and fairly the quality of evidence and detect error, hypocrisy, manipulation, dissembling, and bias – is central to both personal success and national needs."

"A 1972 study of 40,000 faculty members by the American Council on Education found that 97 percent of the respondents indicated the most important goal of undergraduate education is to foster students' ability to think critically."

Process-oriented instructional orientations “have long been more successful than conventional instruction in fostering effective movement from concrete to formal reasoning. Such programs emphasize students’ active involvement in learning and cooperative work with other students and de-emphasize lectures…”

Derek Bok, president emeritus, Harvard, *Our Underachieving Colleges, 2006*

"[colleges and universities]…accomplish far less for their students than they should. Many seniors graduate without being able to write well enough to satisfy their employers. Many cannot reason clearly or perform competently in analyzing complex, non-technical problems, even though faculties rank critical thinking as the primary goal of a college education...

"it is impressive to find faculty members agreeing almost unanimously that teaching students to think critically is the principle aim of undergraduate education…The ability to think critically – to ask pertinent questions, recognize and define problems, identify the arguments on all sides of an issue, search for and use relevant data, and arrive in the end at carefully reasoned judgments – is the indispensible means of making effective use of information and knowledge…"

"What is remarkable, then, is not that professors place so high a value on critical thinking; the wonder…is that they do not do more to act on their belief. Ironically, the fact that college faculties rarely stop to consider what a full-blown commitment to critical thinking would entail may help to explain why they have been so quick to agree on its importance…"

"Faculties have clung to several different visions of education, with no one model proving itself superior in a clearly demonstrable way…Nor has any general theory or universal method emerged to knit the separate disciplines together. The unity of knowledge remains an elusive ideal."

Fragmentation

A cancer in schools, colleges, universities today.

THIS AND THIS

And that and that

And this and this

And that and that

And this and this

And that and that

And this and this

And that and that

TEACHING

That kills the mind

Comenius, 17th Century Educator and Education Critic

School is the slaughterhouse of the mind.

The Cure?

Integrated teaching
and learning

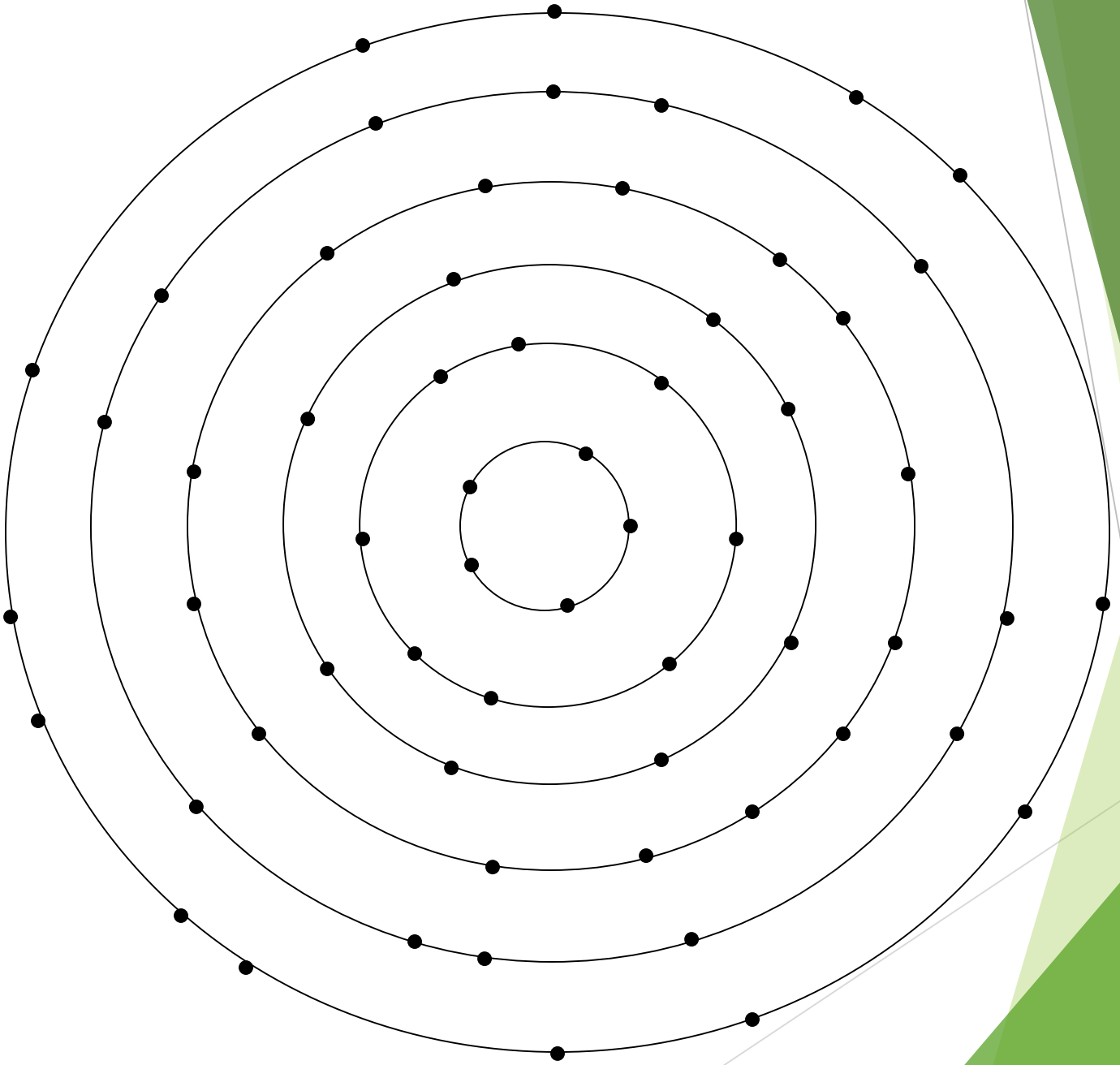
A few things well, not many things badly

John Henry Newman

TEACHING

That gives life, energy and power to the mind.

Circle - Dots



I understand science when I can think scientifically, when I can:

- Formulate scientific questions
- Pursue scientific purposes
- Gather relevant scientific information
- Make reasonable scientific inferences
- Follow out logical scientific implications
- Think within a scientific point of view (or multiple scientific viewpoints)
- Clarify and use scientific assumptions
- Clarify and use scientific concepts

I teach _____.

Therefore I teach my students to *think* _____, *or think* like a _____.

(I teach history. Therefore I teach my students to think *historically*.

I teach botany. Therefore I teach my students to think *botanically*.

I teach nursing. Therefore I teach my students to think like a good nurse).

With this substantive concept, and its implications, clearly in mind, we realize that robust critical thinking should be the guiding force for *all* of our educational efforts.

We begin to see the pressing need for a staff development program that fosters critical thinking within and across the curriculum.

Critical thinking, rightly understood, is not one of many possible “angles” for professional development.

Rather it should be the guiding force behind any and all professional development.

Key Components of a Professional Development Program

1. Choose a substantive conception of critical thinking,
2. Choose a conception that is systematic, integrated, trans-disciplinary and based in intellectual but non-technical language,
3. Choose a conception that fosters traits of mind, as well as intellectual abilities,
4. Commit to the very long run,

5. Reach for deep administrative commitment
6. Establish a leadership team that can move the process forward.
7. Provide ongoing faculty and staff workshops
8. Fund the program
9. Be inclusive
10. Tie critical thinking to assessment, accreditation and the institution's mission.

Why Critical Thinking?

Work in pairs. *Concepts and Tools* Miniguide. Person A, Person B. Critically read page 2 together, using the following method:

1. Person B reads one sentence aloud, then states in his/her own words what has been read. In other words, person B interprets the sentence.
2. Person A then either agrees with the interpretation or offers a different interpretation, adds to the interpretation, etc.
3. During this process, do not critique what you are reading, merely interpret.

4. Person B then reads the second sentence, and the same process occurs.
5. Person A then takes the next two sentences, one sentence at a time, reading, interpreting, getting feedback from person B, using the same method.
6. Take turns reading and interpreting using this method, each person reading and interpreting two sentences, then switching roles, until the entire page is read.

Understood in this way, how is critical thinking relevant to teaching and learning?

How to Study and Learn

Working in pairs, silently read pp. 12-13.

Briefly write a similar explanation of your discipline, field or profession as a form of thinking.

Now share your explanations.

Discuss the significance of this content to teaching and learning.

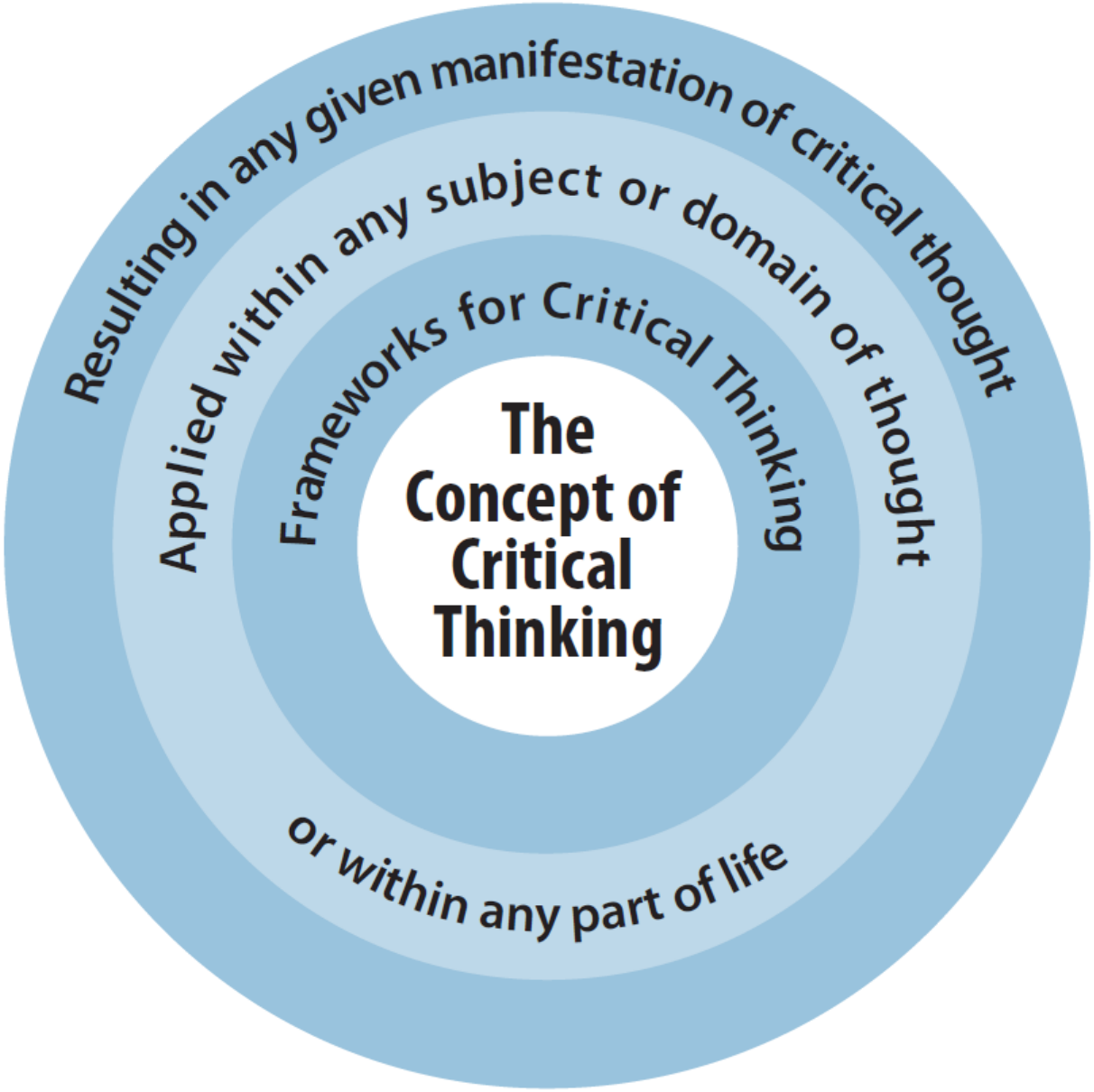
- To what extent do faculty and administrators at your institution have a shared conception of critical thinking?
- How is critical thinking currently viewed at your institution?

Analytic Thinking guide

- Working in pairs, pp. 12-13.
- Read each section, summarize and relate to instruction and/or to your work.

Key questions:

- What is critical thinking?
- To what extent is critical thinking being fostered in schooling?
- Why use our framework for critical thinking?
- What are the primary concepts in our framework?
- What are some essential components in a reasonable professional development process?


The Concept of Critical Thinking
Frameworks for Critical Thinking
Applied within any subject or domain of thought
Resulting in any given manifestation of critical thought
or within any part of life

Underlying Questions

- What is critical thinking?
- What is the relationship between critical thinking and the teaching of content?
- To what extent is critical thinking being fostered in schooling today?

- What are some primary components in our conception of critical thinking?
- How does this conception relate with other potential or actual conceptions?
- What are some essential components in an effective professional development program in critical thinking?

Reference and sources

1. Critical Thinking and Problem Solving: Advanced Strategies and Reasoning Skills to Increase Your Decision Making. A System... by Carl Patterson, Chris del Camino
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3. Thinking Skills: Critical Thinking and Problem Solving by John Butterworth and Geoff Thwaites | Apr 18, 2013
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6. Understanding A3 Thinking: A Critical Component of Toyota's PDCA Management System by Durward K. Sobek II and Art Smalley | Mar 7, 2008