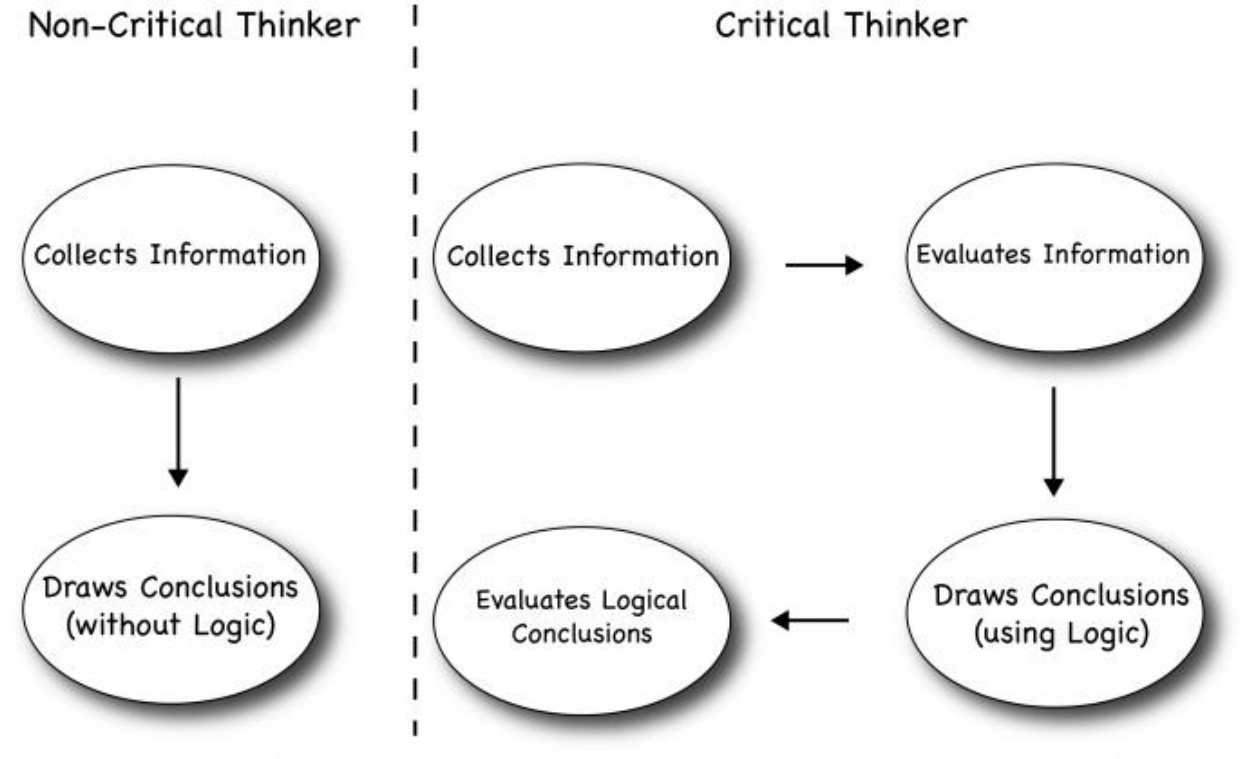
Contents

1. Introduction

Learning to think clearly and carefully takes training, patience, and practice. Thinking carefully with clarity, depth, precision, accuracy, and logic is thinking critically. Great scientists, like Albert Einstein, who discover amazing things about the world, have trained themselves to think critically. Critical thinking is the process of thinking in a certain way. Critical thinking is the process of thinking clearly, with accuracy and precision; of thinking carefully, with logic and depth; and of thinking open-mindedly, by examining points of view and acknowledging assumptions and biases within a given viewpoint. The point is that everyone can learn how to think critically if the time is taken to learn.

Just like math or language or science, critical thinking has necessary tools and a method for using those tools. However, what separates a critical thinker from a non-critical thinker is how she evaluates both the data she's collected and the conclusions she's drawn.



2. Critical thinking tools

Critical thinking tools are questions and There are four main types of critical thinking tools (questions): Getting the Facts, Evaluating the Facts, Drawing a Conclusion using Logic, and Evaluating a Conclusion.

Tools for Getting the Facts

Include questions like “Who?” “What?” “Where?” “When?” and “How?”

Tools for Evaluating the Facts

Include the following types of questions: “Is this fact relevant or significant?” “Is this fact substantial, crucial, and applicable?” and “Does it support the conclusion?”

Tools for Drawing a Conclusion

Use logic to help the critical thinker to avoid making errors by asking: “Is this valid and consistent with other information?” and “Are there any logical flaws in this conclusion?”

Tools for Evaluating a Conclusion

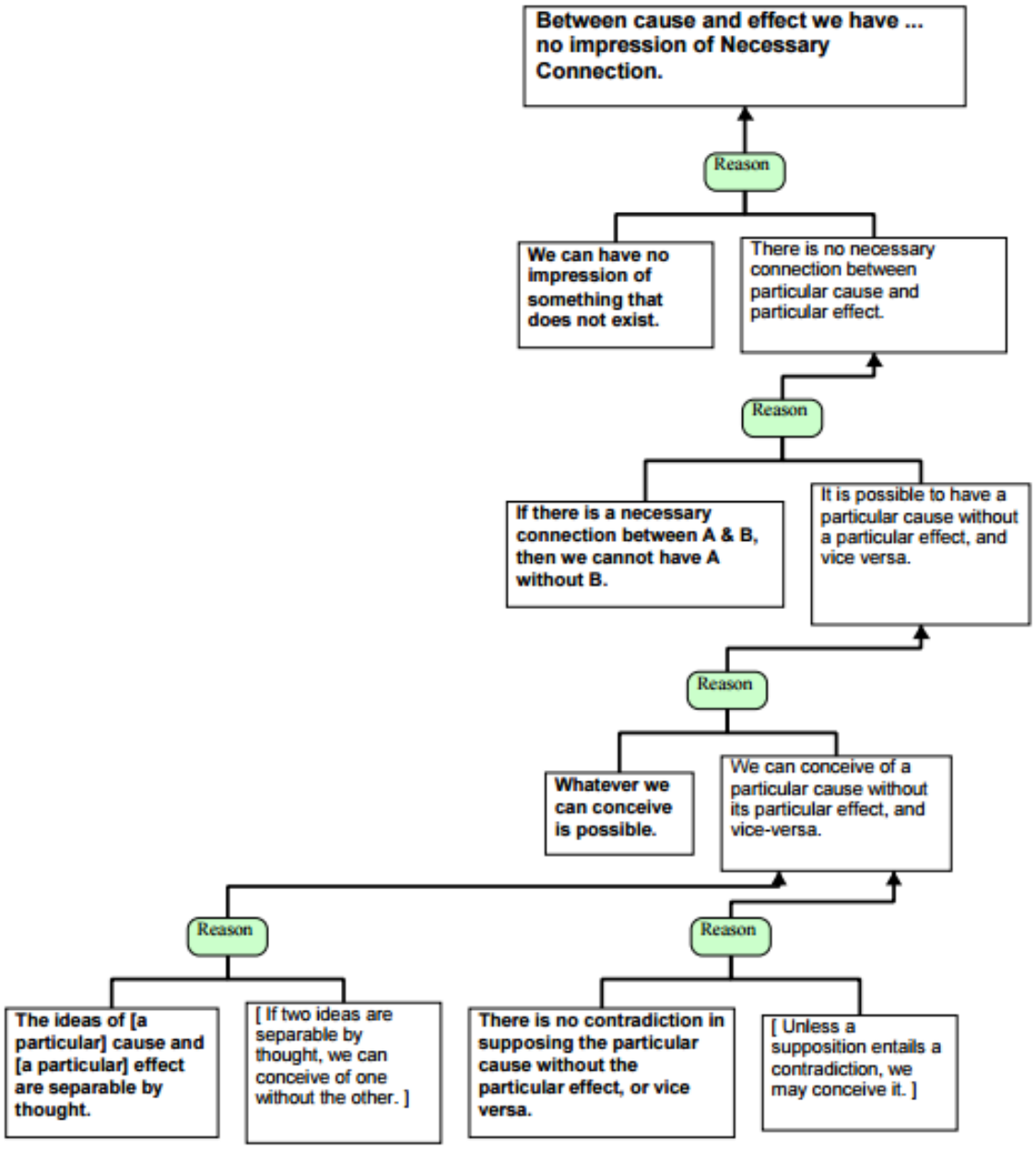
Include the following types of questions: “Is this fair and reasonable?” and “Does my conclusion have the necessary depth and breadth?”

3. Critical Thinking lens

A critical thinking lens can help you think through problems more clearly. Constructing a critical thinking lens is not very difficult. It amounts to asking questions using the four critical thinking tools we have been learning. As you improve your ability to ask good questions, your critical thinking lens will improve. A critical thinking lens can help you decide what kinds of statements are scientifically valid, and what kinds of statements may not be scientifically valid.[1]

4. Using Argument Maps

In fact, argument maps improve critical thinking. “ In addition to the strong empirical data in favor of the argument-mapping-based Reason! approach, I have the strong impression that students really were learning to understand the structure of arguments better, and forcing themselves to think clearly. Several said they were using maps to plan other essays and felt it helped. Despite my own training in analytic philosophy, I feel that mapping helps me with my own thinking.” Figure shows why.[2]



5. Using questions

Some questions used to stimulate critical thinking included:

- What is your point of view?
- What are your reasons for supporting this point of view?
- Why do you think that?'

- Are there different perspectives on the issue?

- Who is the author?
- Can you figure out who the author is?
- Is the person who is providing the information someone who is knowledgeable about the topic?
- What is their motivation?
- How reliable is the information?
- Is the information based on scientific evidence?
- Is there similar information given across reliable sources?
- How well does the site explain the information?
- Do you understand how the process works based on the information provided?
- Does the explanation fit together with your prior scientific knowledge or with information from other reliable sites? [3]

6. Tips for improve argument

6.1. Environment and activity

1. Summarize or put into own words what the teacher or another student has said.

2. Elaborate on what they have said.

3. Relate the issue or content to own knowledge and experience.

4. Give examples to clarify or support what they have said.

5. Make connections between related concepts.

6. Restate the instructions or assignment in their own words.

7. State the question at issue.

8. Describe to what extent their point of view on the issue is different from or similar to the point of view of the instructor, other students, the author, etc.

9. Take a few minutes to write down any of the above.

10. Write down the most pressing question on their mind at this point. The instructor then uses the above tactics to help students reason through the questions.

11. Discuss any of the above with a partner and then participate in a group discussion facilitated by the instructor.[4]

12. Provide enough wait-time for students to reflect when responding to inquiries.

13. Provide emotionally supportive environments in the classroom encouraging reevaluation of conclusions.

14. Prompt reviews of the learning situation, what is known, what is not yet known, and what has been learned.

15. Provide authentic tasks involving ill-structured data to encourage reflective thinking during learning activities.

16. Prompt students' reflection by asking questions that seek reasons and evidence.

17. Provide some explanations to guide students' thought processes during explorations.

18. Provide a less-structured learning environment that prompts students to explore what they think is important.

19. Provide social-learning environments such as those inherent in peer-group works and small group activities to allow students to see other points of view.

20. Provide reflective journal to write down students' positions, give reasons to support what they think, show awareness of opposing positions and the weaknesses of their own positions.[5]

6.2. Critical thinking pertains to teaching and learning

Critical thinking pertains to teaching and learning can be considered an open-minded process of

- discovery and understanding
- analysis and application
- Synthesis and evaluation.

These three groupings and their six components reflect B. S. Bloom's (et al-1956) hierarchical taxonomy or breakdown of cognitive educational objectives.

What does the application of critical thinking look like in the class or school room?

- New learning is introduced with what is already known
  (Ausubel 1968)
- Goals and objectives, and their framework, are clear
  for considering and acquiring new material
- Generalization and conceptualization are integrated
  into the learning process; and are frameworks for understanding what is taught
- Internalization of knowledge is a goal,
  and a risk
- Learning not only draws upon the teacher,
  but also fellow learners and content in many media formats, and can follow non-traditional avenues
- Inquiry and questioning are teaching tools;
  as is lecture
- Demonstration of learning is integral to the learning process
- Standards of evaluation are clear at the outset

What does a typical class period look like?
(Accommodates 20 minute attention spans)

- Introductory phase
  Review previous day, homework assignments
  Bridge new material with advanced organizers
- Lecture or content presentation
  Perhaps through Socratic method of questioning
- Small group discussions and tasks
- Period of reflection or exercises in applying new material,
  or review
- Reports
- Summaries/exercises/developmental/application/demonstration activities

6.3. Guided notes

Guided Notes are teacher-prepared hand-outs that outline or map lectures, but leave "blank" space for key concepts, facts, definitions, etc. as the lecture progresses, the learner then fills in the spaces with content.

Guided notes help learners

- follow a lecture
- identify its important points
- distinguish between main and secondary points, examples and digressions

- develop a foundation of content to study and to apply

What are Guided Notes?

- **Examine existing lecture outlines**
  (or create them as necessary) to identify the most important course content that students must learn and retain via lecture. Remember: less can be more.
  Student learning is enhanced by lectures with fewer points supported by additional examples and opportunities for students to respond to questions or scenarios
  (Russell et al., 1984)
- **Delete the key facts, concepts, and relationships**
  from the lecture outline, leaving the remaining information to provide structure and context for students' note taking
- **Enhance the lecture with supporting information and resources.**
  Insert and present outlines and concept maps; diagrams and charts; images, illustrations and photos; highlighted statements or concepts that are particularly important (e.g., Big Ideas), and resources such as bibliographies and websites into Guided Notes
- **Insert (a consistent, standard set of) formatting cues**
  such as highlighting, sequences, images, asterisks, lines, and bullets to show students where, when, and how many facts or concepts to write
- **Use PowerPoint slides or overhead transparencies**
  to project key content. Visually projecting the key facts, definitions, concepts, relationships, etc. that students must write in their Guided Notes helps ensure that all students access the most critical content and improves the pace of the lecture
- **Leave ample space for students to write.**
  Providing about three to four times the space needed to type the content will generally leave enough room for students' handwriting
- **Do not require students to write too much.**
  Using Guided Notes should not unduly slow down the pace of the lecture. Two studies found that students' exam scores for lectures taught with Guided Notes that could be completed with single words and short phrases were as high as their test scores over lectures taught with Guided Notes that required more extensive writing to complete (Austin & Sasson, 2001; Courson, 1989)

6.4. Constructing true/false tests

What happens: Learner

- Analyzes a statement
- Assesses whether true or false
- Marks an answer

When/how to use:

- Appropriate for all levels of cognitive ability
- Objective
- Efficient in testing recall and comprehension of a broader content area relative to other testing strategies
- Well suited to test recall, comprehension of simple logic or understanding, as with "if-then" "causal/because" statements

- Not appropriate to test the ability to read or interpret complex sentences or understand complex thoughts
- Sufficiently reliable and valid instrument:
  Its ability to include the most test items in a time frame increases its reliability.
  True false tests are less reliable than multiple choice tests unless relatively more test items are used
- Useful for automated scoring
- Useful for item analysis, internal and over time

Ideal test items

Critical content should be readily apparent and identified for analysis, avoiding cleverness, trickery, and verbal complexity

- Use simple, direct language in declarative sentences
- Present the correct part of the statement first,
  and vary the truth or falsity of the second part if the statement expresses a relationship (cause, effect--if, then)
- Statements must be absolute without qualification,
  subject to the true/false dichotomy without exceptions
- Every part of a true sentence must be "true"
  If any one part of the sentence is false,
  the whole sentence is false despite many other true statements.
- Paraphrase, and do not directly quote,
  course content to avoid burdening students with detailed verbal analyses, maintain focus on differentiating, as well as avoid copyright issues
- Include background, qualifications, and context as necesary:
  "According to...., ..."
- In developing a question with a qualifier, negative or absolute word,
  substitute or experiment with variations to find the best phrase and assessment

Avoid

- Unfamiliar vocabulary and concepts
- Long strings of statements
- Ambiguous statements and generalizations
  that are open to interpretation
- Indefinite or subjective terms
  that are open to interpretation
  "a very large part" "a long time ago" "most"
- **Negative words and phrases: they can be confusing**
  IF negatives are necessary, they are emphasized with underlined, bolded, CAPITALIZED, italicized, and/or colored indicators
  e.g.: "no" "not" "cannot"
  Drop the negative and read what remains to test your item
- Absolute words restrict possibilities.
  These imply the statement must be true 100% of the time and usually cue a "false" answer
  e.g.: "No" "never" "none" "always" "every" "entirely" "only"
- **Relative and qualifying words restrict or open up general statements.**
  They make modest claims, are more likely to reflect reality, and usually cue a "true" answer.
  e.g. "usually" "often" "seldom" "sometimes" "often" "frequently" "ordinarily" "generally"

- **Pay close attention to**
  negatives, qualifiers, absolutes, and long strings of statements

Variations in answers:

- Base questions upon introductory material,
  as graphs, images, descriptions, problems, mediated objects, etc. to
  Enhance assessment value
  Accommodate and empower those with alternative learning styles
  Evoke higher level thinking, analysis, or problem solving
- Add an option to "True" "False" possibility, as "Opinion"
- Ask for an elaboration on the answer, as
  "True" "False"
  If so, Why?
- Ask for a correction to false statements

Test instructions:

- Before the test, give clear, proactive instructions
  on what content is covered,
  level of detail, and what type of questions will be asked:
  Encourage comprehension: cause and effect, if/then, sequences,
  Avoid memorization
- Detail exactly what must be exactly memorized:
  dates, locations, proper names, sequences
- Be consistent in test administration over time
- Have students indicate their answers by circling
  complete words of "true" "false" (not "t" "f")
  Do not have students write their response of t/f or true/false to (avoids distinguishing/problems of hand writing and sloppiness)
  Avoid plus or minus signs "+" of "-"
- Indicate how the test is scored:
  total right, or total right minus wrong?

How to develop a true/false test:

1. Write out essential content statements
2. Convert half to false, though not negative, statements
3. Make true and false statements equal in length
4. Group questions by content
5. Build up to difficulty
   (encourage with simpler questions first)
6. Randomize sequences of T/F responses
   Avoid a discernable pattern
7. Vary the quantity of true/false statements from test to test
   recognizing that "true" is marked more often in guessing, and
   that assessing false statements tends to be more challenging

Limitations:

- Scoring tends to be high
  since guessing yields a 50-50 score (half right half wrong) as a base. i.e. if there are 100 items, and

the student knows the correct answer to 50, and guesses on the other half, the score will be 75 knowing only half the material.

- Since the stem can cue a correct answer,
  guessing is enhanced without really understanding the question
- The format does not provide diagnostic information
  on why a student got it wrong
- It may be easy to cheat
- Content can be simplistic and/or trivial [6]

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