

# Differences between Critical Thinking and Information Literacy

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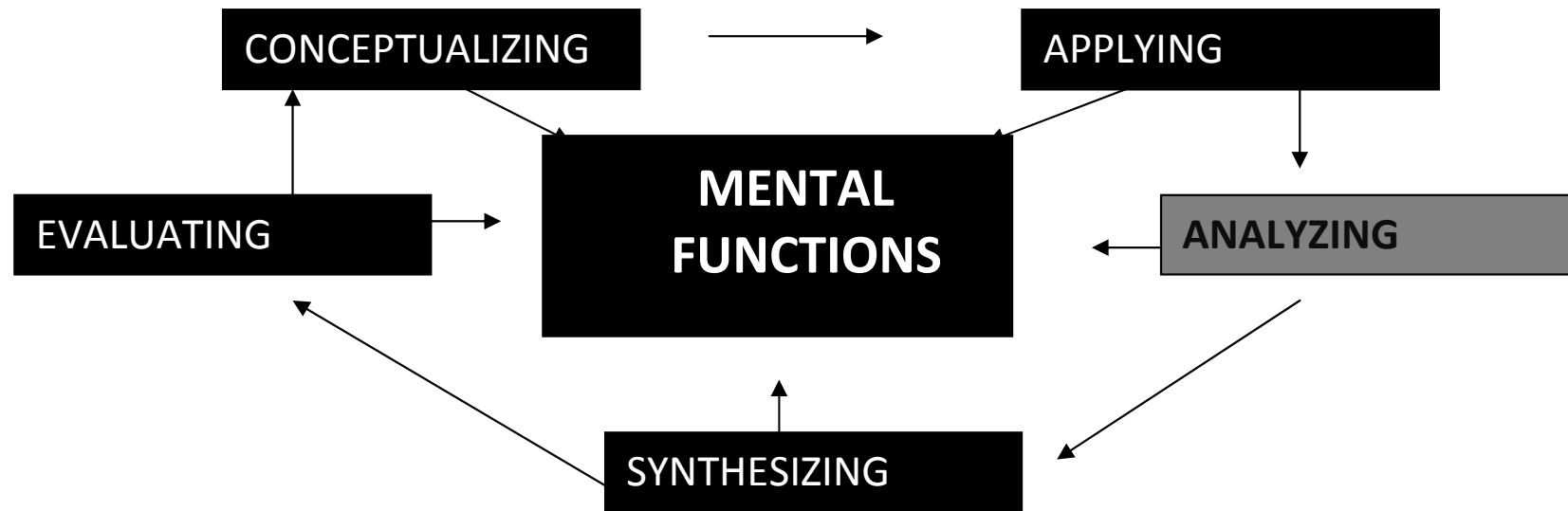
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# Issues Considered

- **Theoretical Bases?**
  - Learning and processing information
- **Literature Analysis?**
  - Results of a formalized, public approach to analysis of text dealing with critical thinking and information literacy
- **Description of Analytic Method?**
  - Idea and its role in text mining

# What is Critical Thinking?



***“the mental process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and evaluating information to reach an answer or conclusion”.***

(<http://www.Dictionary.com> 2011)

# What is Bloom's Taxonomy of Learning?

- ***Cognitive Functions***

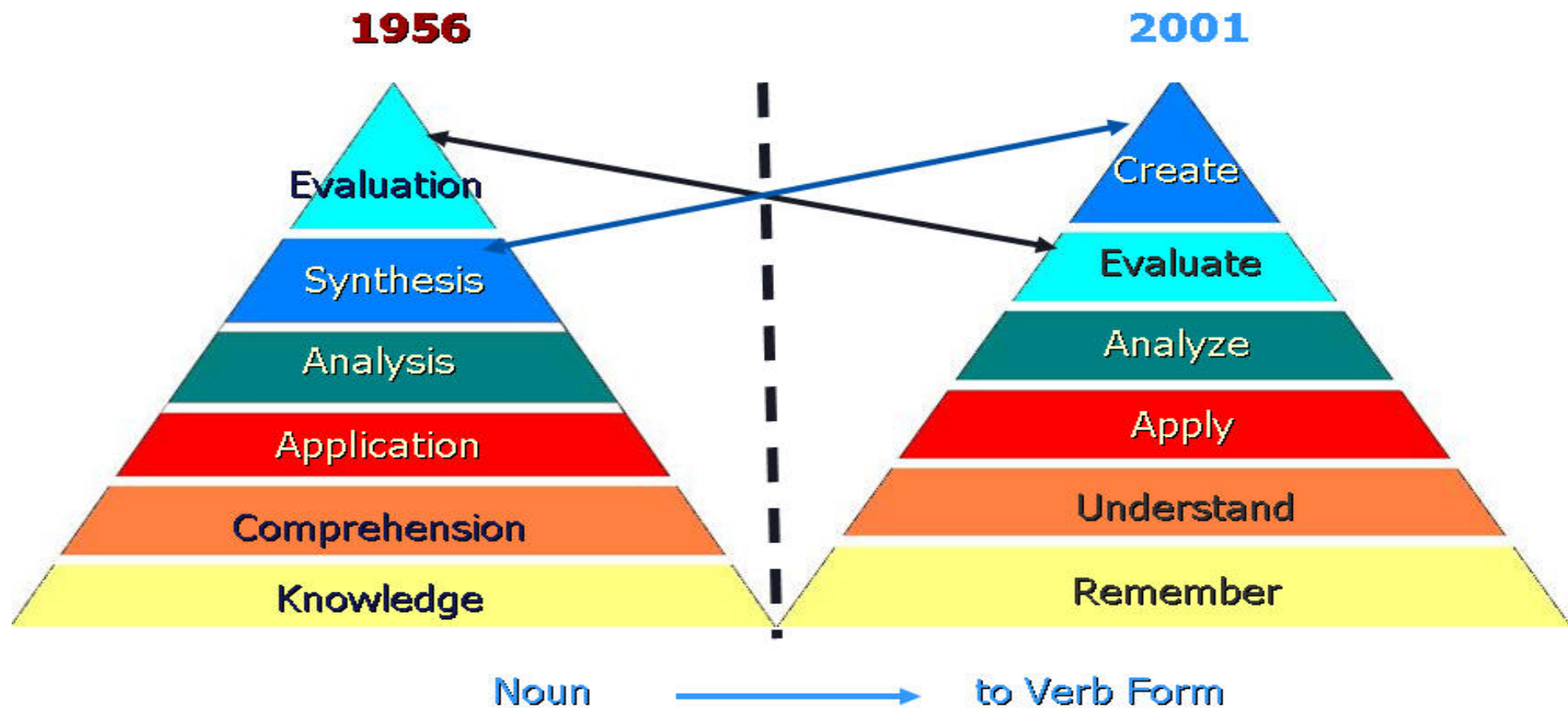
- Knowledge
- Understanding
- Application
- Analysis
- Synthesis
- Evaluation

- **The individual must have the knowledge and be capable of identifying, retrieving, and organizing it so that a particular use can be considered. The acquired material must be divided into parts and those reorganized to better fit the new purpose. The resulting product must be assessed for its worth.**

- *[Taxonomy of Educational Objectives: The Classification of Educational Goals; pp. 201–207; B. S. Bloom (Ed.) Susan Fauer Company, Inc. 1956.]*

# Bloom's Taxonomy of Learning Revised

## Changes to Bloom's



# Comparison of First Cognitive Function

- **Bloom's Taxonomy 1956**

- **1. Knowledge:** Remembering or retrieving previously learned material. Examples of verbs that relate to this function are:

- know  
identify  
relate  
list
- define  
recall  
memorize  
repeat
- record  
name  
recognize  
acquire

- **Anderson & Krathwohl 2001**

- **1. Remembering: Retrieving, recalling, or recognizing** knowledge from memory. Remembering is when memory is used to produce definitions, facts, or lists, or recite or retrieve material.

- <http://www.uwsp.edu/education/lwilson/curric/newtaxonomy.htm>

- Anderson, L. W. and David R. Krathwohl, D. R., et al (Eds..) (2001) *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Allyn & Bacon. Boston, MA (Pearson Education Group)
- Bloom, B.S. and Krathwohl, D. R. (1956) *Taxonomy of Educational Objectives: The Classification of Educational Goals, by a committee of college and university examiners. Handbook I: Cognitive Domain*. NY, NY: Longmans, Green

# Another revision

- **Cognitive Functions**
- **Recall/Retrieval** -- Search, Identify, Retrieve data
- **Analysis** -- Separate the information into components
- **Synthesis** -- Combine the elements into new arrangements
- **Comparison** -- Compare the new arrangements using measures and criteria
- **Evaluation** -- Rank the arrangements using the established criteria
- **Judgment** -- Select the 'better' arrangements
- **Application** -- Using this reorganized information, create a new product (e.g., description of the topic, strategy to develop new information)

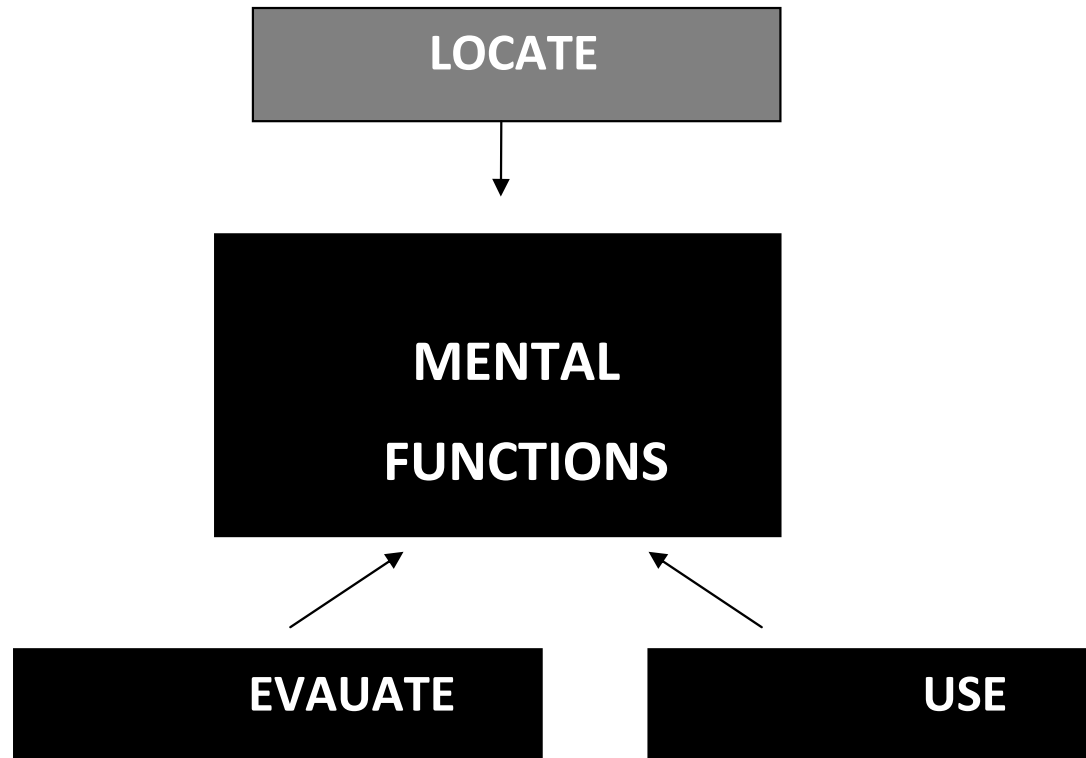
# Translating Terms into Actions

- Search
  - User provides a pattern
  - Software compares user pattern against stored patterns
- Identify
  - Software finds a match and captures the locations containing the specified pattern
- Retrieve
  - Software goes to designated locations
  - Software copies records containing pattern and displays them

# What is Information Literacy?

- ***"To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information."*** [ALA 1989].
- ***"Information literacy is a set of competencies that an informed citizen of an information society ought to possess to participate intelligently and actively in that society"*** [AASL 1998].

# What is information literacy?



# Overview – Literature Analysis

- Differences Between Critical Thinking and Information Literacy -- 16,946 documents
  - 8745 articles dealing with critical thinking
  - 8201 reports dealing with information literacy
- [Repositories -- ERIC, PubMed (2000-2009)]

# What is the basic data element in the literature analysis?

- **Thoughts or ideas**
  - “any conception existing in the mind as a result of mental understanding, awareness, or activity. [<http://dictionary.com>]
- **Forming the thought could be private**
- **Recognizing the thought could be public.**
- **Difference → Idea Analysis**
  
- *[Weiner, J.M.: Issues in the Design and Evaluation of Medical Trials. G.K. Hall & Co., Boston, 1979.]*

# Idea Analysis Software

- **Developed as a Research Tool**
  - Feasibility of using Ideas
- **Segregates each sentence**
- **Identifies the informative terms in the sentence**
- **Combines the terms as pairs to form ideas**
- **Data record**
  - **idea and associated identifying information**
- Weiner JM et al. *Methods in Knowledge Utilization*. 2009, XXIV Century Press.  
<http://www.amazon.com>
- Weiner JM. *Effective Creativity in the Workplace*, 2011, Lambert Academic Publishing Co.  
<http://www.amazon.com>

# Ideas within a Sentence

- “PBL pedagogy developed **information literacy** skills, **critical thinking**, and evidence-based nursing skills, communication, co-operation and team working skills, problem solving and self-assessment skills.”

<u>Information Literacy</u>	<u>Critical Thinking</u>
• PBL	PBL
• Pedagogy	Pedagogy
• Skill	Skill
• Evidence	Evidence
• Communication	Communication
• Working	Working
• Problem	Problem
• Solving	Solving
• Assessment	Assessment

# Excerpt from the Idea Database

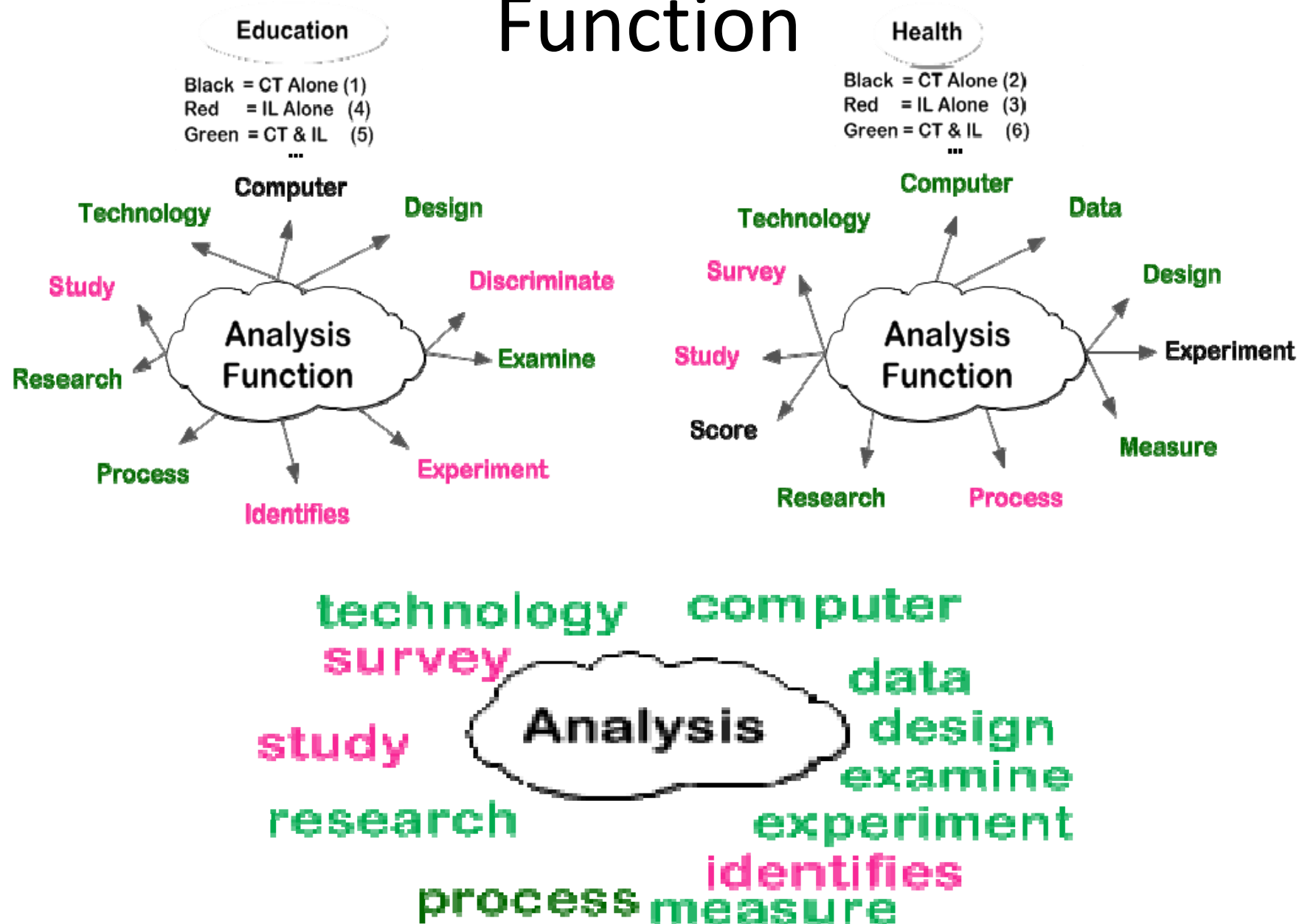
<u>Critical</u>	<u>Thinking</u>	<u>Related</u>	<u>Year</u>	<u>Ident</u>	<u>Sentence</u>
critical	thinking	ability	2007	EJ799752	7
critical	thinking	ability	2009	EJ842292	6
critical	thinking	academic	2001	EJ633187	1
critical	thinking	academic	2008	EJ833913	2
critical	thinking	accuracy	2003	EJ676508	2
critical	thinking	acquisition	2007	EJ799752	7
critical	thinking	addition	2006	EJ740423	2
critical	thinking	application	2001	EJ633187	1
critical	thinking	article	2006	EJ744251	1
critical	thinking	article	2005	EJ763686	3
critical	thinking	bibliographic	2001	EJ633189	1
critical	thinking	citation	2006	EJ744251	1
critical	thinking	classroom	2001	EJ633187	1
critical	thinking	classroom	2001	EJ633189	1
critical	thinking	collaboration	2000	EJ608483	2
critical	thinking	collaboration	2001	EJ633187	1

# Comparison of Frequencies (Ranks) of Terms Linked with IL and CT.

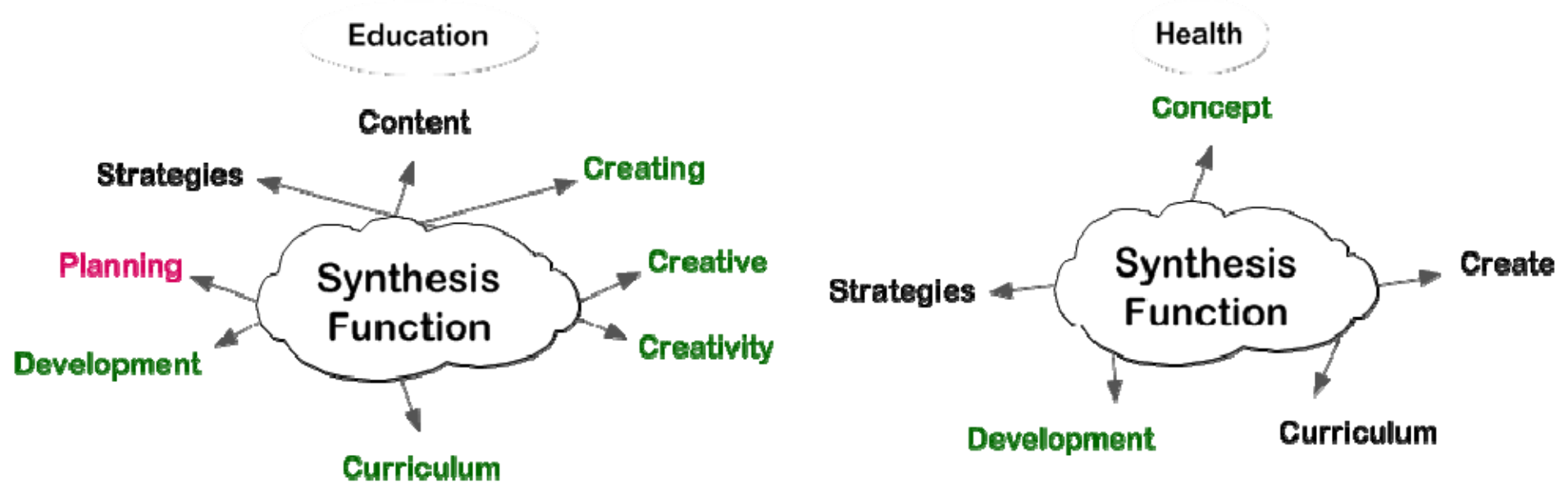
<u>Terms</u>	<u>IL Rank</u>	<u>CT Rank</u>
learning	1	1
student	3	2
skill	7	3
examine	13	4
technology	4	6
literacy	20	7
development	29	8
education	30	9
knowledge	31	10
model	32	11
research	33	18
effective	12	19
ability	34	20
assess	35	21
enhance	36	22
experiment	37	23
faculty	38	24
important	39	25
study	27	26

# Comparison of Triadic Ideas – Analysis

## Function

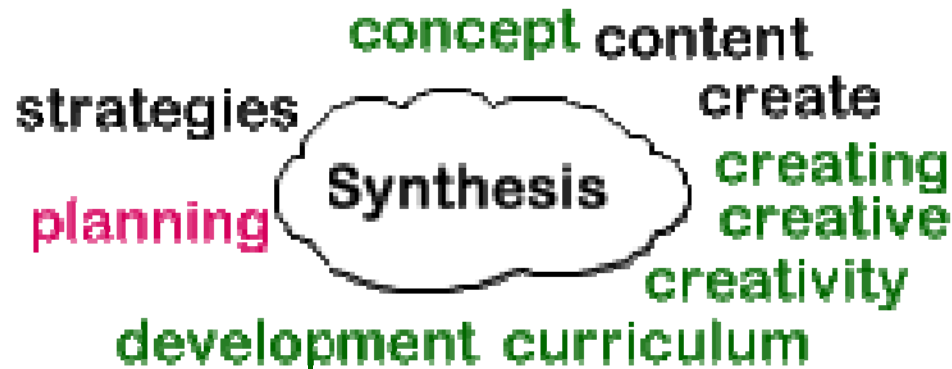


# Comparison of Triadic Ideas – Synthesis Function

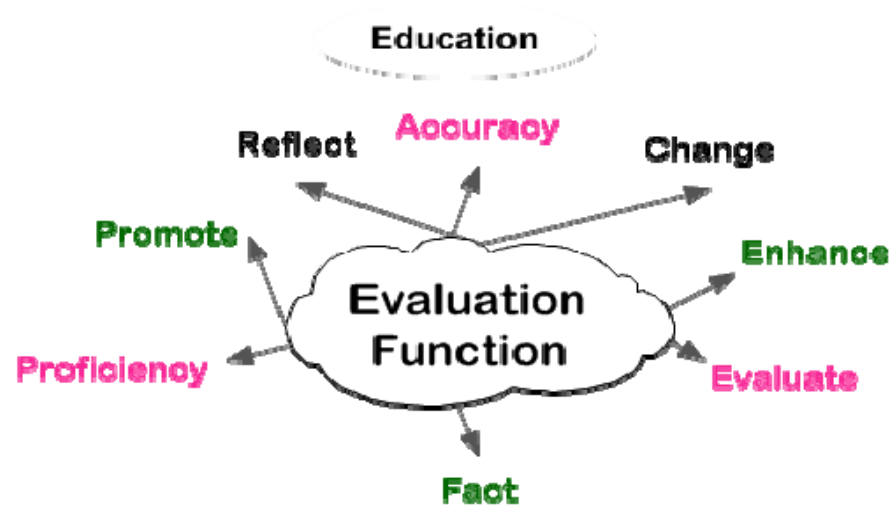


Black = CT Alone (2)  
 Red = IL Alone (1)  
 Green = CT & IL (5)  
 ...

Black = CT Alone (3)  
 Red = IL Alone (0)  
 Green = CT & IL (2)  
 ...



# Comparison of Triadic Ideas – Evaluation Function



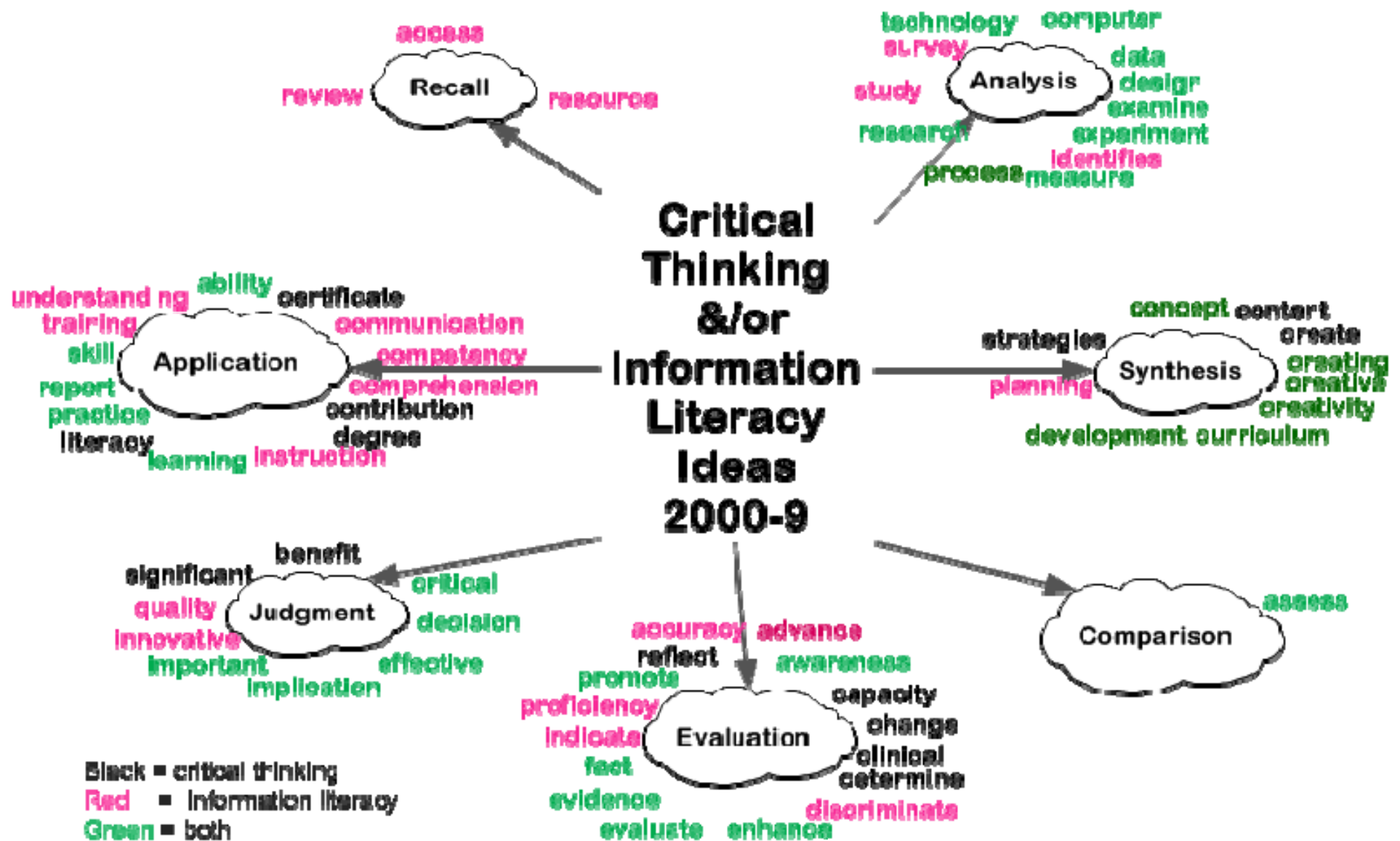
Black = critical thinking  
 Red = Information literacy  
 Green = both



Black = critical thinking  
 Red = Information literacy  
 Green = both



# Full Array of Cognitive Functions



# Information Literacy – Higher Cognitive Functions

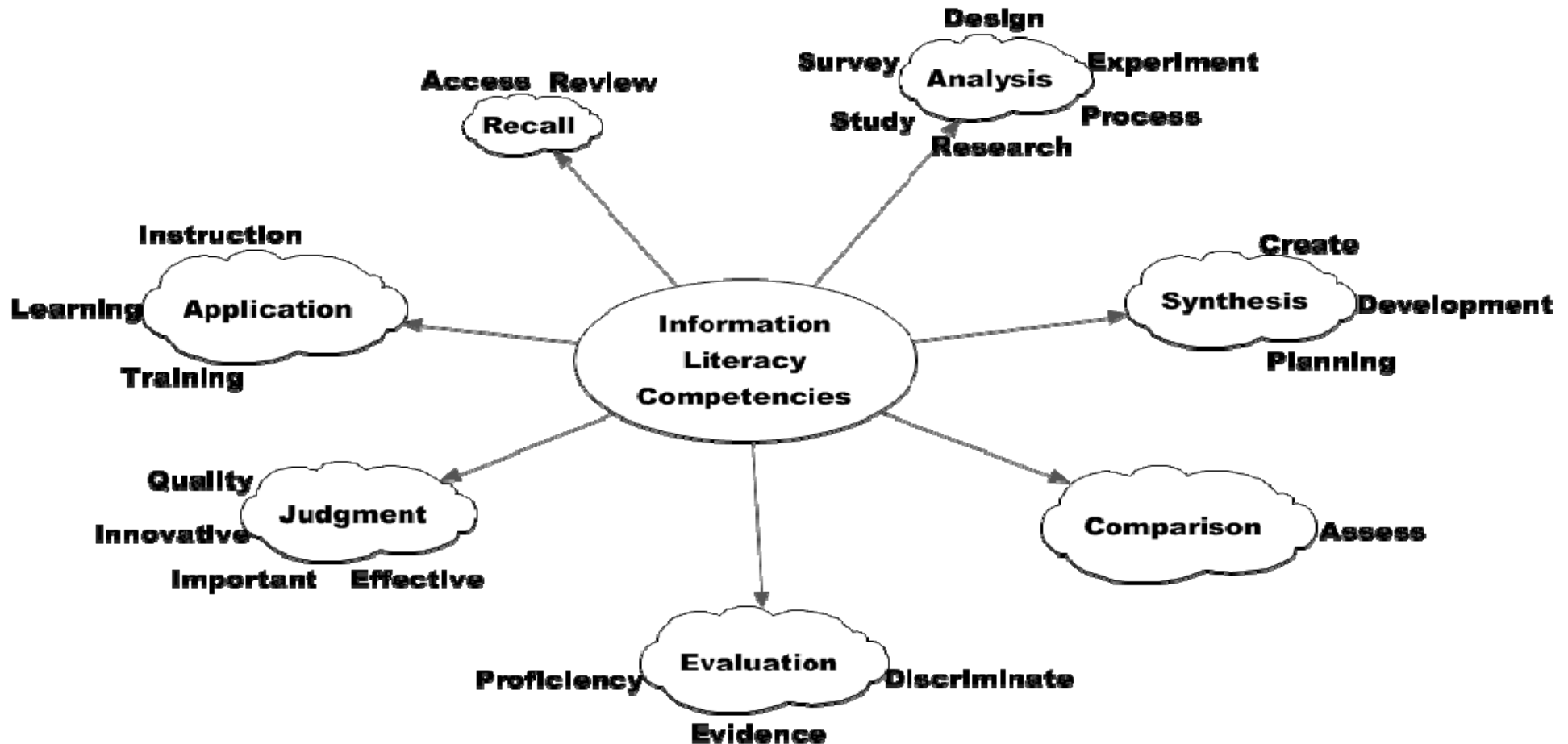
<b><u>Evaluation</u></b>	<b><u>Judgment</u></b>	<b><u>Application</u></b>
• Accuracy	Quality	Communication
• Advance	Innovative	Competency
• Discriminate		Comprehension
• Indicate		Instruction
• Proficiency		Training
•		Understanding

# Attributes of Two Learning Approaches

- |                                   |                                    |
|-----------------------------------|------------------------------------|
| • <b><u>Critical Thinking</u></b> | <b><u>Information Literacy</u></b> |
| • <b>Individualized</b>           | <b>Public</b>                      |
| • <b>Discipline Specific</b>      | <b>Across Disciplines</b>          |
| • <b>Solve Problem</b>            | <b>ProblemS</b>                    |
| • <b>Learn New</b>                | <b>Continuing Learning</b>         |
| • <b>Individual's Status</b>      | <b>Decision-making</b>             |

# Information Competences:

## Terms Linked with Information Literacy



"Information literacy is a **set of competencies** that an informed citizen of an information society ought to possess to participate intelligently and actively in that society"[AASL 1998].

# Effective acquisition and management of knowledge

## → resolution of local and global problems

- **Degree of Formalism associated with Cognitive Processes**

- **Private** -- personal and not publicly expressed.
- **Public** -- open to the view of all.

- **Learning Behavior Employed**

- **Self-Learning** -- student assumes responsibility for selecting subjects and learning content. Teacher serves as a facilitator.
- **Traditional forms** -- lecture and textbook instruction.

- **With the existing expertise in dealing with text and in working with clients in a large number of disciplines, the information literacy librarians may be better equipped to produce the needed techniques.**

# Attitudes of Conference Participants?

- Favorite Learning Methods?
- Structure of Text?
- Differences between Numbers and Text?

# Question 1

- Identify the learning method that is most satisfying **to you** in accomplishing your objectives?
  - a. Traditional classroom lecture?
  - b. Self-exploration of topics?
  - c. Self-exploration plus guidance by specialist?
  - d. Collaborative team arrangement?

# Question 2

- Identify the component **most** important in communication between individuals?
- a. The words used?
- b. The ideas conveyed?
- c. The images presented?

# Question 3

- Why are numeric data processed easily using an algorithmic approach?
- a. Statistical operations are easier to perform?
- b. There is a 'natural' order to numbers?
- c. Numbers can be assigned to represent physical or abstract objects more easily than can text?
- d. Individuals attracted to the physical sciences are lazier and want algorithms so that the work is done more easily and faster?

# Text Analysis – Manual Methods

- **Retrieve** Abstracts from Repositories -- 16946 in **2 minutes**
- **Triage** Abstracts to determine relevance – 15 seconds x 16946 = 70.6 hours
- **Identify data** in 8473 x 10 minutes = 1412.2 hours
- **Prepare data records** for 8473 x 5 minutes = 706.1 hours
- **Total Time = 2,188.9 hours (273.6 8-hour days)**

# Text Mining for Theme Related Groups

- **Retrieve** Abstracts from Repositories -- 16946 in **5 minutes**
- **Triage Theme groups** to determine relevance  
– 15 seconds x 16946 = 70.6 hours
- **Identify data** in 8473 x 10 minutes = 1412.2 hours
- **Prepare data records** for 8473 x 5 minutes = 706.1 hours
- **Total Time = 2188.9+ hours**

# Text Mining for Content

- **Retrieve** Abstracts from Repositories
- **Identify data**
- **Prepare data records** for 16946
- **Create knowledge resource**
- **Total Time** – 0.2 minutes x 16946 = **56.5 hours (7, 8 hour days)**

# Critical Thinking = Information Literacy?

- If Critical Thinking employed modern technologies, instead of individualized mental processes, would it be called Information Literacy?