



Promoting Critical Thinking in Science with Concept Maps

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Inclusion of Student-Centered Pedagogies in STEM Courses Grant

Critical Thinking...

- Is important for success in today's world
- Is the foundation of STEM fields

Yet...

- It is complex and hard to define
 - “the disciplined mental activity of evaluating arguments or propositions and making judgments that can guide the development of beliefs and taking action” –(Huitt, 1998)
- It is difficult to teach and evaluate

Core Critical Thinking Skills

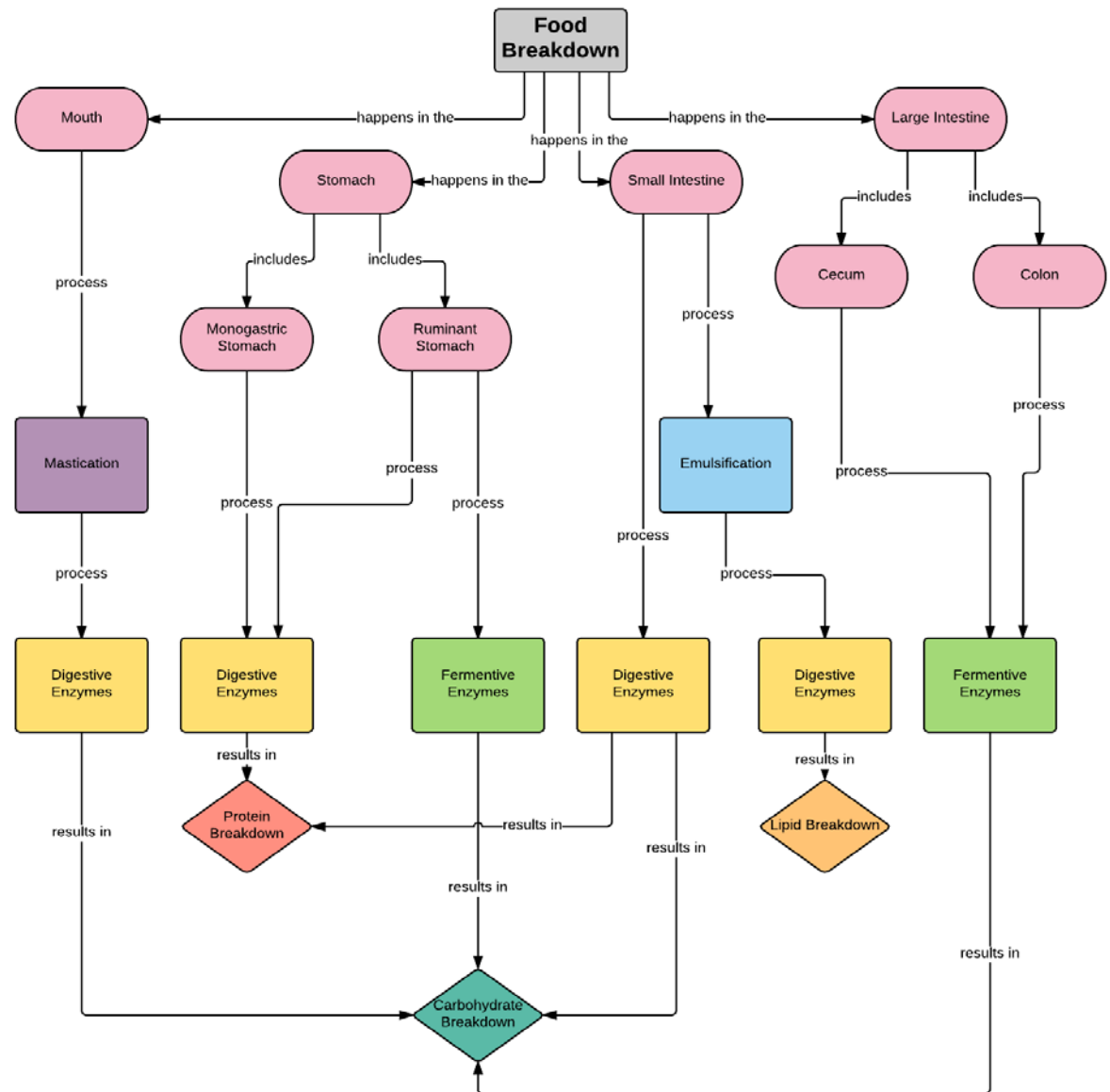
- Interpretation
- Explanation
- Analysis
- Evaluation
- Inference
- Self-regulation (“questioning, confirming, validating, or correcting either one’s reasoning or one’s results”)

(from Facione, 2015)

Concept Maps as a Tool to Teach and Evaluate Critical Thinking Skills

- **Concept maps:** graphical tools for representing and organizing information in a way that shows relationships between ideas
 - Intuitive
 - Can make them in many ways
 - Versatile (many different types)

Hierarchy Concept Map Example



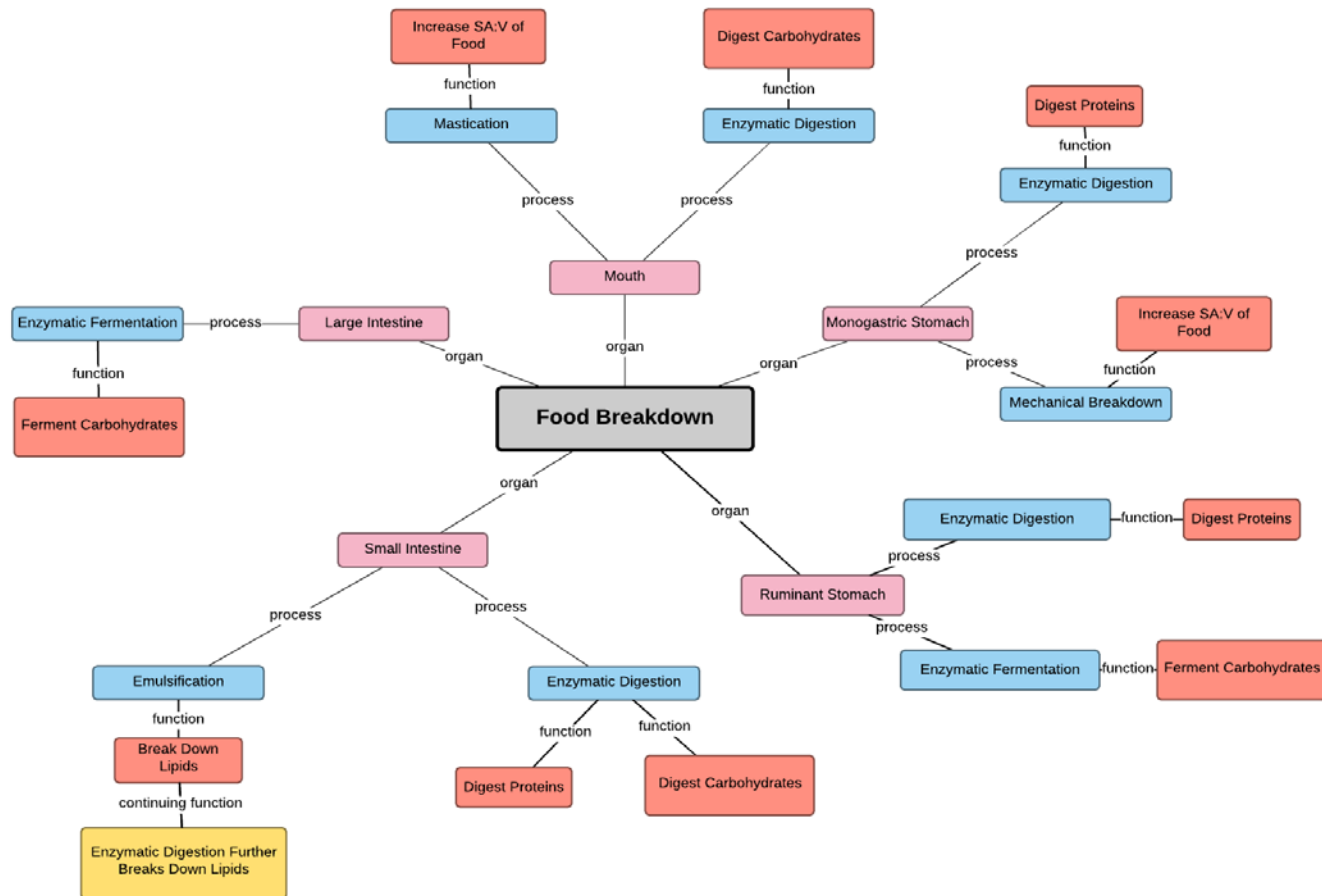
Hierarchy
Concept Maps
are good for:

- Categorizing information
- Organizing a paper

Spider Concept Maps are good for:

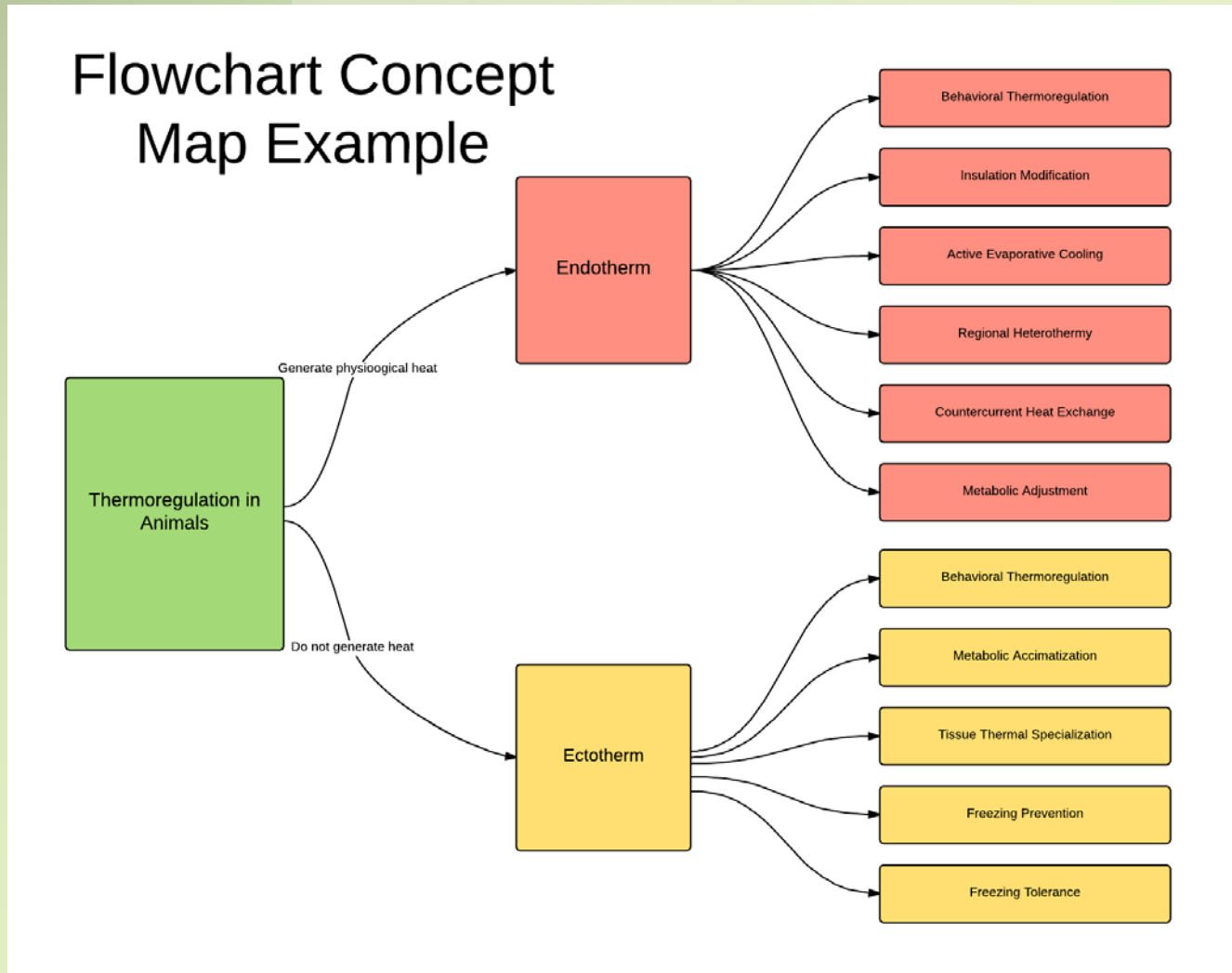
- Categorizing highly interconnected information
- Identifying subtopics that are richer than others

SPIDER CONCEPT MAP EXAMPLE



Flowchart Concept Maps are good for:

- Decision making
- Process analysis



Using Concept Maps to Interpret, Explain, Analyze, Infer, and Self-regulate: Example Assignment

- Have students create a concept map to show how concepts from class are interrelated
 - Individually or as a group
 - In person or online
 - On paper or on computer
 - Powerpoint (collaborate with OneDrive)
 - Word (textboxes and arrows; collaborate with OneDrive)
 - Lucidchart (collaborative mode is costly)
 - Many, many other options online

Lucidchart Example:

The screenshot displays the Lucidchart web interface. At the top, the Lucidchart logo is on the left, and navigation links for DOCUMENTS, INTEGRATIONS, TEAM, and HELP are on the right. A user profile for Sarah.Jane.Alger@uwsp.edu is visible in the top right corner. The main dashboard area features a left sidebar with 'My Documents' containing folders for Section1, Section2, and Section3, and sections for Recent Documents, Shared with Me, and Trash. The central workspace shows a grid of document thumbnails: three empty folders labeled Section2, Section1, and Section3; a 'Copy of Example Hierarchy Concept Map' showing a complex flowchart; and a 'Copy of Flowchart Concept Map Example' showing a hierarchical diagram. Below these are two more thumbnails: 'Copy of spider concept map example' and 'Diving Mammal Concept Map Template'. A 'Related' section at the bottom left includes promotional cards for a Free Amazon Gift Card, Office Integration, and Try AWS Import.

Lucidchart Example:

Diving Mammal Concept Map: Group 1

File Edit View Page Arrange Insert Share Window Help Saved

Page 1

1 pt B I U 0 px None

search

STANDARD

FLOWCHART

SHAPES

Diving Mammal Concept Map

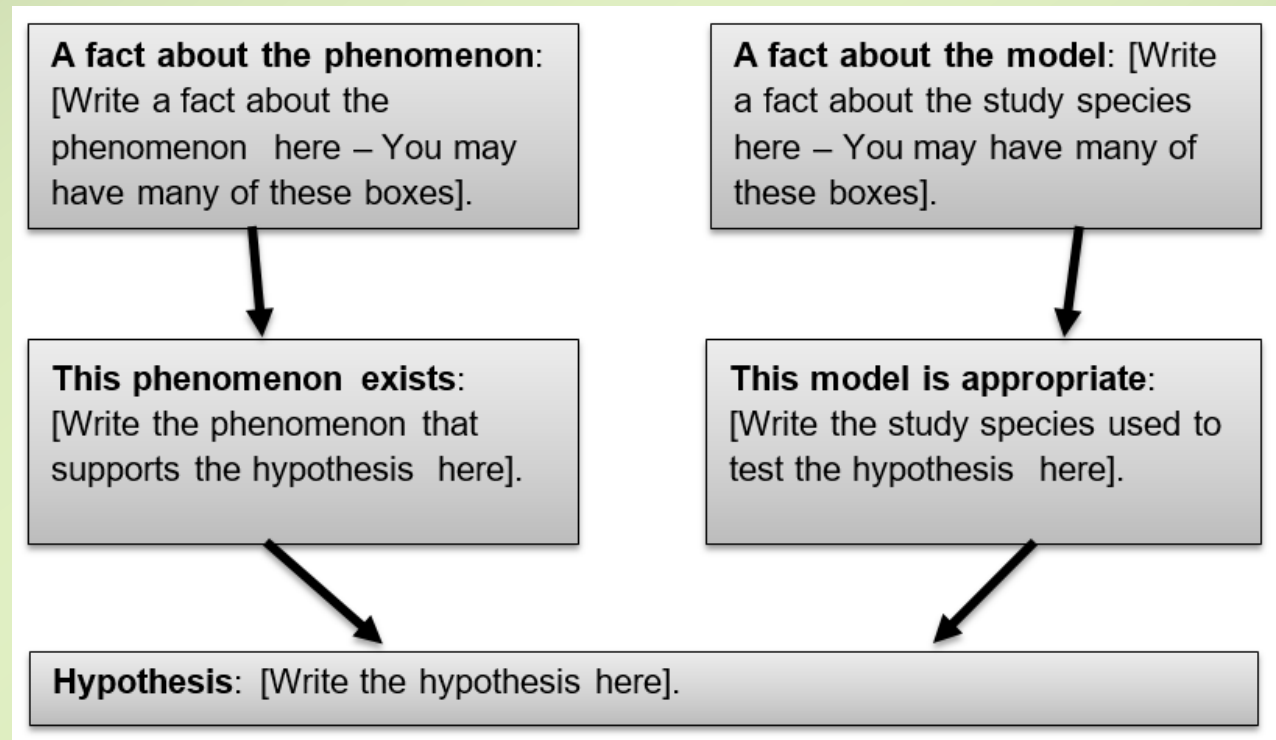
HISTORY

- 10:45 AM: Sarah.Jane.Alger@uwsp.edu
- Apr 19 12:15 PM: Sarah.Jane.Alger@uwsp.edu
- Apr 10 6:00 PM: [REDACTED]
- Apr 10 5:51 PM: [REDACTED]
- Apr 10 5:49 PM: [REDACTED]
- Apr 10 5:45 PM: [REDACTED]
- Apr 10 5:43 PM: [REDACTED]

Using Concept Maps to Interpret, Evaluate, and Explain: Example Assignment

- Have students create a scientific rationale map from a research paper introduction to show how hypotheses are developed from previous evidence

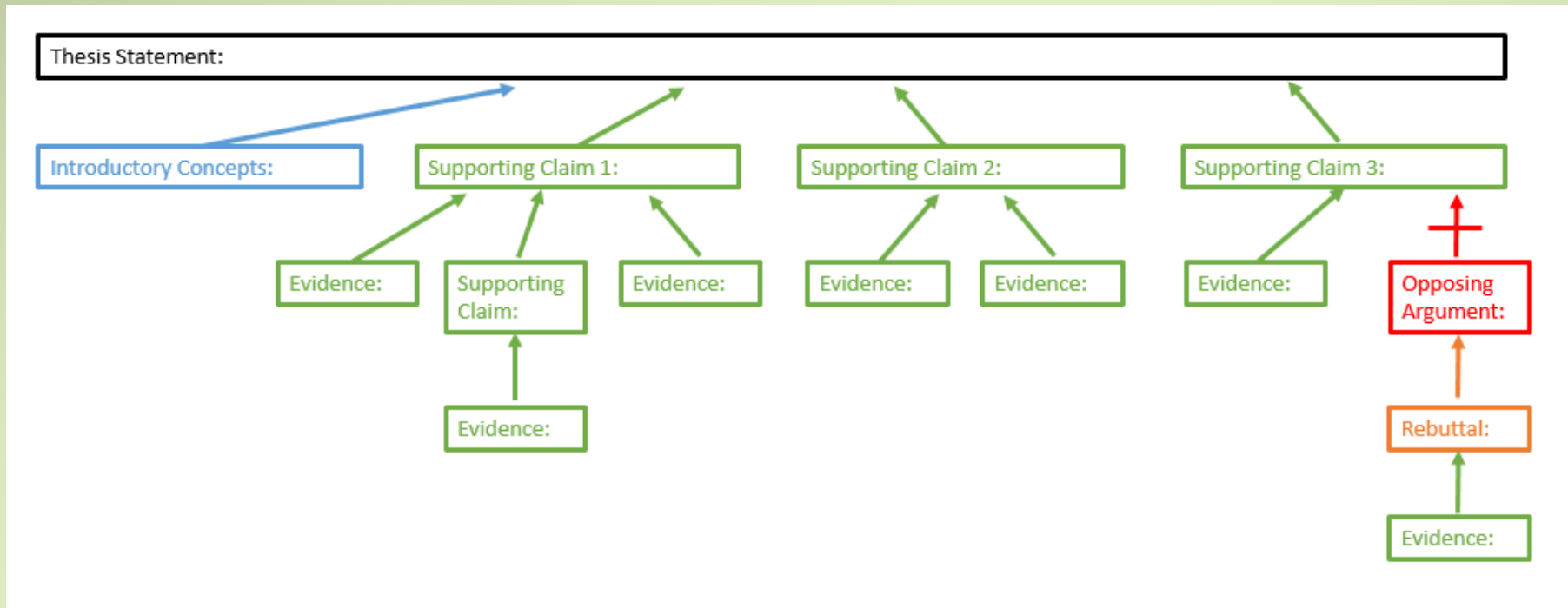
Word Example:



Using Concept Maps to Analyze, Evaluate, Explain, and Self-regulate: Example Assignment

- Have students develop and analyze an argument map of a thesis prior to writing a review paper

PowerPoint Example:



References and Resources

- Facione, P. (2015). "Critical Thinking What It Is and Why It Counts." from *InsightAssessment.com*.
- Huitt, W. (1998). Critical thinking: An overview. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University.

Thank You!

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