

Promoting Science Passage Comprehension via Concept Mapping Instruction

Alpana Bhattacharya, Ph.D.

Associate Professor of Educational Psychology

Queens College, The City University of New York

Alpana.Bhattacharya@qc.cuny.edu

Concept Map: Definitions

- ❑ Concept maps are diagrams showing network of concept nodes connected by relational links (Haugwitz, Nesbit, & Sandmann, 2010).
 - ❑ Concept maps are schematic devices for representing interrelationships among a set of concept meanings embedded in a framework of propositions and two-dimensional, hierarchical, node-like diagrams that represent verbal, conceptual, or declarative knowledge in visual or graphic forms (Kwon & Cifuentes, 2009).
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Concept Mapping: Benefits

Haugwitz, Nesbit, & Sandmann (2010)

- ❑ Concept maps use less text than prose format to present information
 - ❑ Concept maps display many relationships involving a single concept without rewriting the concept
 - ❑ Concept maps are easier to read because of simpler syntax
 - ❑ Concept maps allow more semantic processing in visuospatial working memory and avoid overloading verbal working memory
 - ❑ Concept maps are suitable for summarizing text passages because verbatim reproduction of text is not required
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Research Study: Concept Mapping Instruction

Al Khawaldeh & Al Olaimat (2010)

- ❑ Eleventh grade students (16 - 17 years)
 - ❑ Concept mapping (34 students) versus traditional instruction (36 students)
 - ❑ Cellular respiration concepts (Biology)
 - ❑ Pre-test, posttest, and delayed posttest
 - ❑ Concept mapping instruction group had better acquisition of science concepts than the traditional instruction group
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Research Study: Concept Mapping Instruction Odom & Kelly (2001)

- ❑ Eleventh grade students (Biology class)
 - ❑ Concept mapping (26 students) versus expository instruction (27 students)
 - ❑ Diffusion and osmosis concepts
 - ❑ Immediate and delayed diagnostic test
 - ❑ Concept mapping instruction enhanced learning of diffusion and osmosis more effectively than expository instruction
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Research Study: Collaborative Concept Mapping

Haugwitz, Nesbit, & Sandmann (2010)

- ❑ Secondary school students (13–14 years)
 - ❑ Concept mapping condition (39 groups: 123 students) versus essay writing condition (38 groups: 125 students)
 - ❑ Biology topics: heart function, arteries, capillaries, veins, and blood circulation
 - ❑ Five achievement posttests
 - ❑ Concept mapping groups got higher scores on posttest than the essay writing group
 - ❑ Concept mapping groups produced summaries containing more valid propositions
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Research Study: Collaborative Concept Mapping Kwon & Cifuentes (2009)

- ❑ Seventh grade students (Science class)
 - ❑ Concept mapping (31 pairs: 62 students) versus self-selected strategy (40 students)
 - ❑ Topics: weathering, soil, and erosion
 - ❑ Multiple choice test (10 items)
 - ❑ Collaborative concept mapping positively influence science concept learning
 - ❑ Concept mapping leads to deeper understanding of interrelationships among concepts than other study strategies
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Concept Mapping Instruction

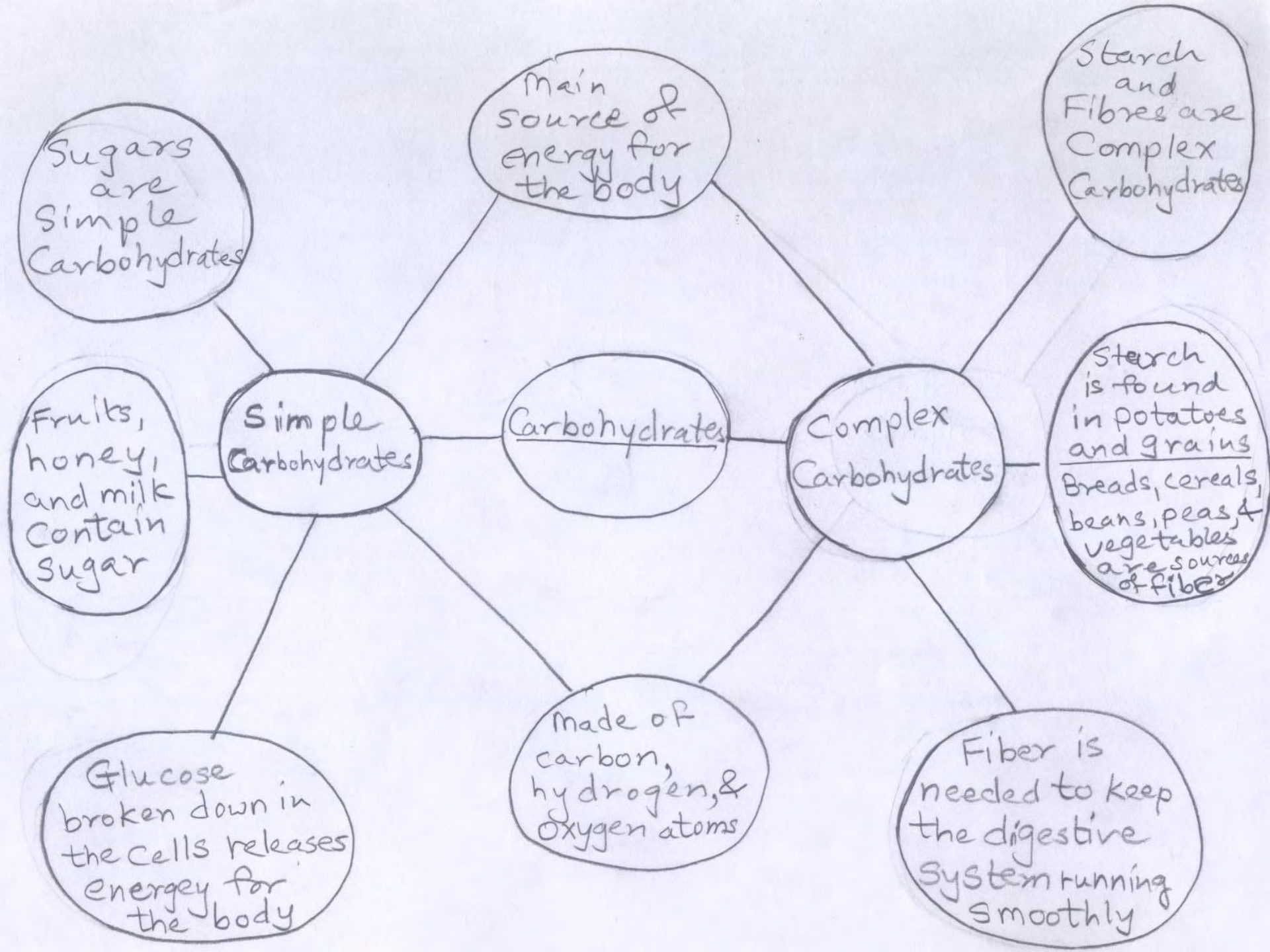
- Instruction Phase
 - Modeling
 - Practicing
 - Summarizing
 - Assessment Phase
 - Maps
 - Questions
 - Summaries
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Instruction Phase

□ Mapping

- Compare-Contrast: Carbohydrates
- Classification: Sponges
- Cause-Effect: Leaf

□ Summaries



Carbohydrates

Carbohydrates usually are the main sources of energy for the body. There are three different types of carbohydrates: Sugar, starch, and fiber. Sugar is in fruits, honey, and milk, and are also called simple carbohydrates. Starch is found in potatoes and grains, and is called complex carbohydrates. Fiber is found in breads, cereals, and vegetables and is also called complex carbohydrates. Fiber is needed to keep the digestive system running smoothly.

Sponges

Saltwater Sponges

1. Live in warm, shallow salt water.
2. They are brilliant red, orange, yellow, or blue.
3. They are asymmetrical.
4. Most of the 5,000 species of sponges are found in salt water near coastlines or at ocean depths of 8,500 m.

Freshwater Sponges

1. Live in freshwater rivers, lakes, and streams.
2. They are dull brown or green.
3. They could have radial symmetry.
4. They can be smaller than a marble or larger than a compact car.

Adult Sponges

1. Live attached to one place during their lifetime.
2. They are called sessiles because they remain attached.
3. They are found with other sponges in permanent groups (i.e., colonies).
4. They are animals because they cannot make their own food.

Sponges

Sponges live in deep or shallow salt water and in fresh water. They have brilliant colors and live in colonies or groups. They also have different sizes and shapes. Sponges are animals because they do not produce their own food. They attach themselves to rocks or a place, but occasionally they would break off because of rough currents.

Outer cell layer: Causes

1. Epidermis is covered with waxy cuticles.
2. Epidermis is transparent.
3. Epidermis contains small openings.

Stomata: Causes

1. Guard cells surround each stoma.
2. Water moves into guard cells.
3. Guard cells lose water.
4. Stomata opens during the day.
5. Stomata closes at night.

Inside the Leaf: Cause

1. Carbon dioxide and water vapor fills the spongy layer.

LEAF

Outer Cell layer: Effects

1. Keeps leaf from drying.
2. Sunlight reaches the cells inside the leaf.
3. Doorways for raw materials to enter and exit the leaf.

Stomata: Effects

1. Guard cells control stoma size.
2. Guard cells swell and bend apart; opens stoma.
3. Guard cells deflate; closes stoma.
4. Plants take in raw materials to make food.
5. Less water vapour escapes from the leaf.

Inside the Leaf: Effect

1. Food is made in the palisade layers.

Leaves

Leaves are made of many different layers. The outer cell layer is called the epidermis, which is almost transparent. A waxy layer called the cuticle covers the epidermis. The epidermis has small openings. These openings are called Stomata. Two guard cells surround each Stoma. The Stoma lets carbon dioxide, water vapor, and gases enter and exit. Stomata are open during the day and close at night. The inner two layers of the leaf are: Spongy layer and Palisade layer. The Spongy layer holds in the carbon dioxide and water vapor, while the Palisade layer is where the food is made.

Assessment Phase

- Mapping
 - Compare-Contrast: Fish
 - Classification: Brain
 - Cause-Effect: Disease
 - Questions
 - Fact
 - Inference
 - Summaries
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Assessment Phase: Concept Map Scores

<input type="checkbox"/> Fish: Compare/Contrast	18 points
<input type="checkbox"/> Brain: Classification	16 points
<input type="checkbox"/> Disease: Cause/Effect	24 points
	<hr/>
Total	58 points

Concept Maps: Analytic Scoring

1. General concepts have been accurately identified

All Most Several Few None

2. Specific concepts have been accurately identified

All Most Several Few None

3. Links between general and specific concepts are appropriate

All Most Several Few None

4. Links illustrate accurate comparative, hierarchical, or casual relationships

All Most Several Few None

5. Appropriate words and phrases have been used to identify concepts

All Most Several Few None

Assessment Phase: Question Scores

- Fish:
 - Fact Question 4 points
 - Inference Question 2 points
- Brain:
 - Fact Question 2 points
 - Inference Question 4 points
- Disease:
 - Fact Question 2 points
 - Inference Question 4 points

Total 18 points

Assessment Phase: Summary Scores

Fish: 18 points

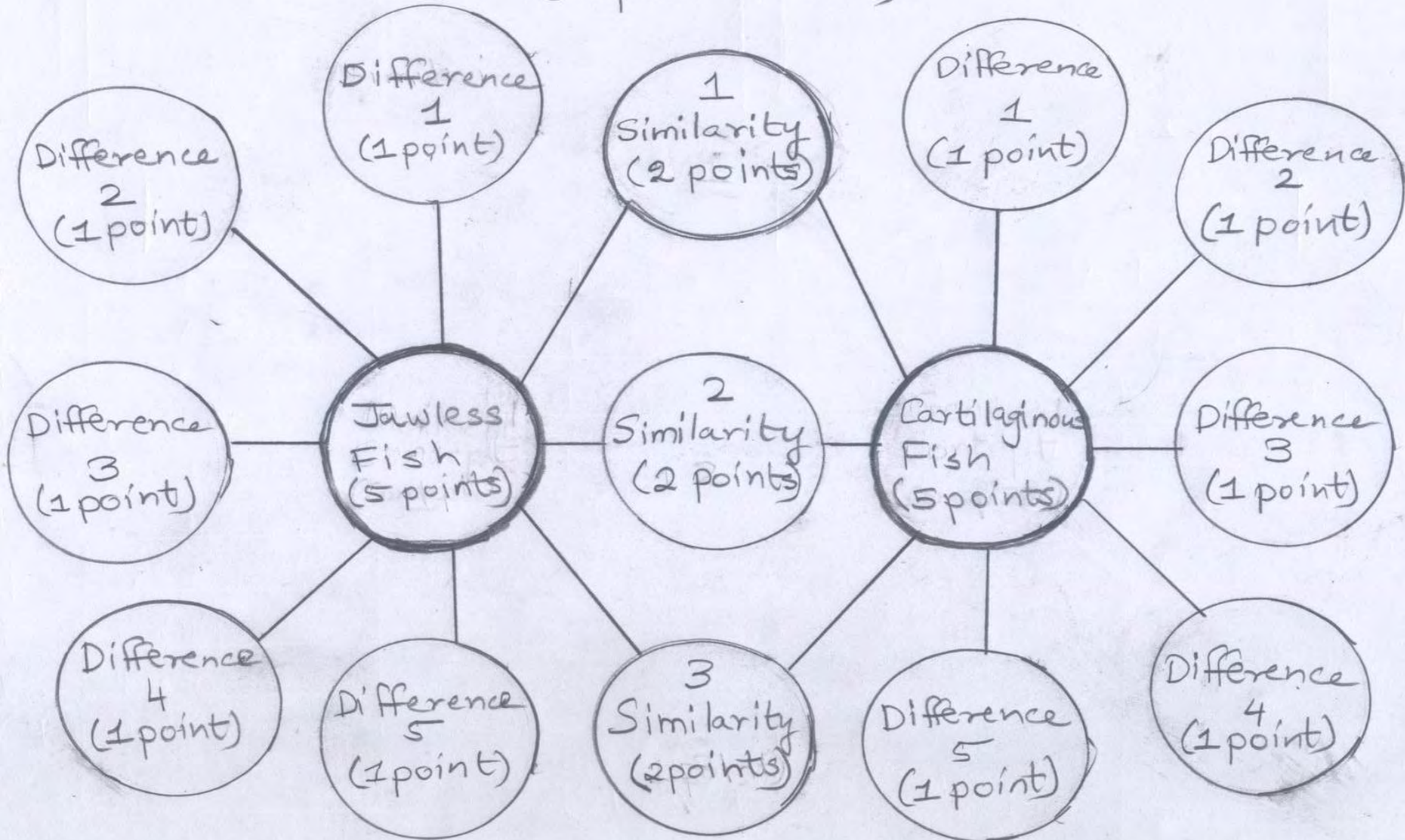
Brain: 16 points

Disease: 18 points

Total 52 points

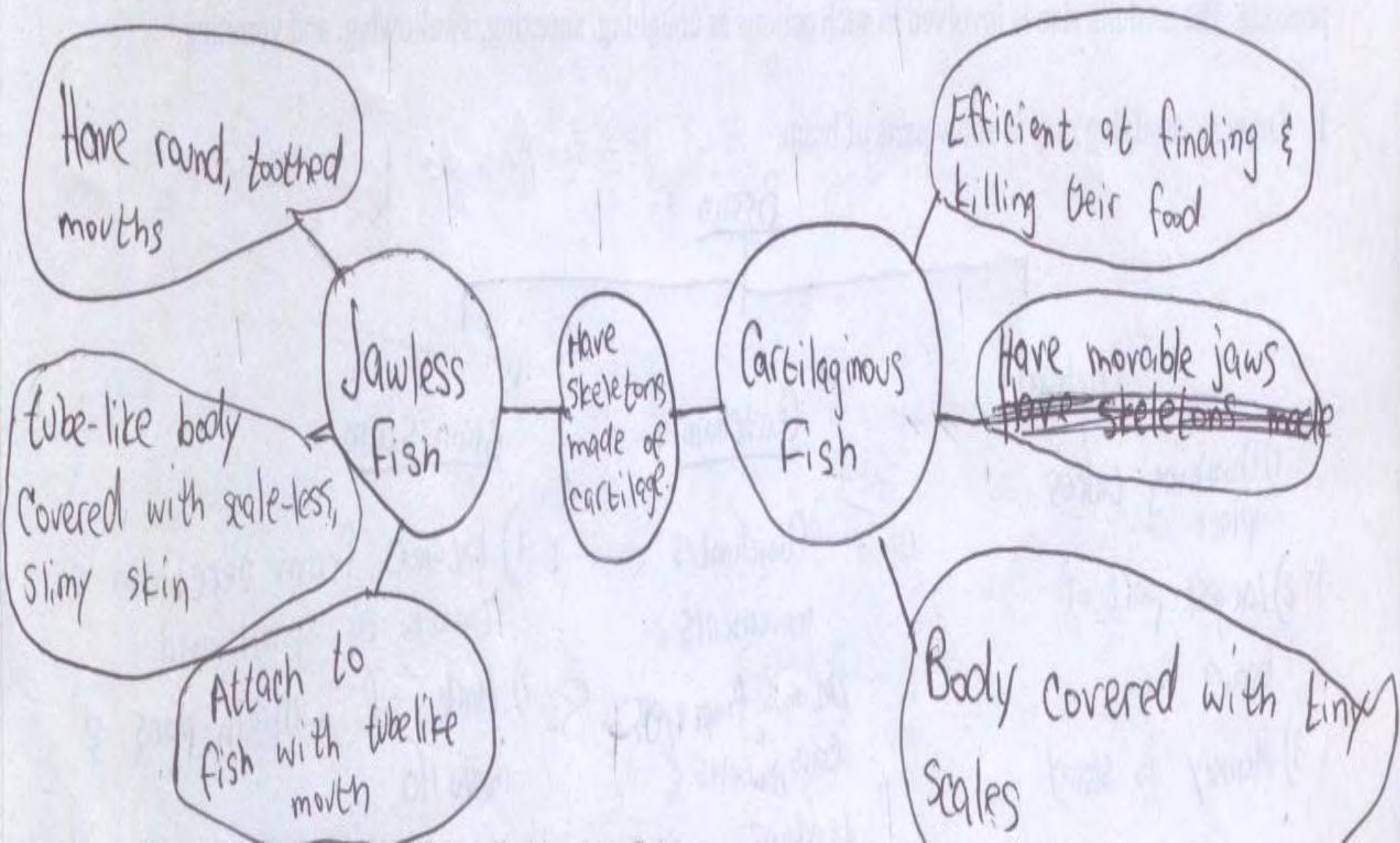
Compare/Contrast Map: Numerical Scoring Template

Compare-Contrast Map
(16 points - Fish)



Fish: Compare-Contrast Map

1. Draw a double bubble map to compare and contrast fish.



Fish: Questions

2. Why are lamprey and hagfish called jawless fish?

Because they have round, toothed mouths and long, tube-like bodies covered with scale-less, slimy skin.

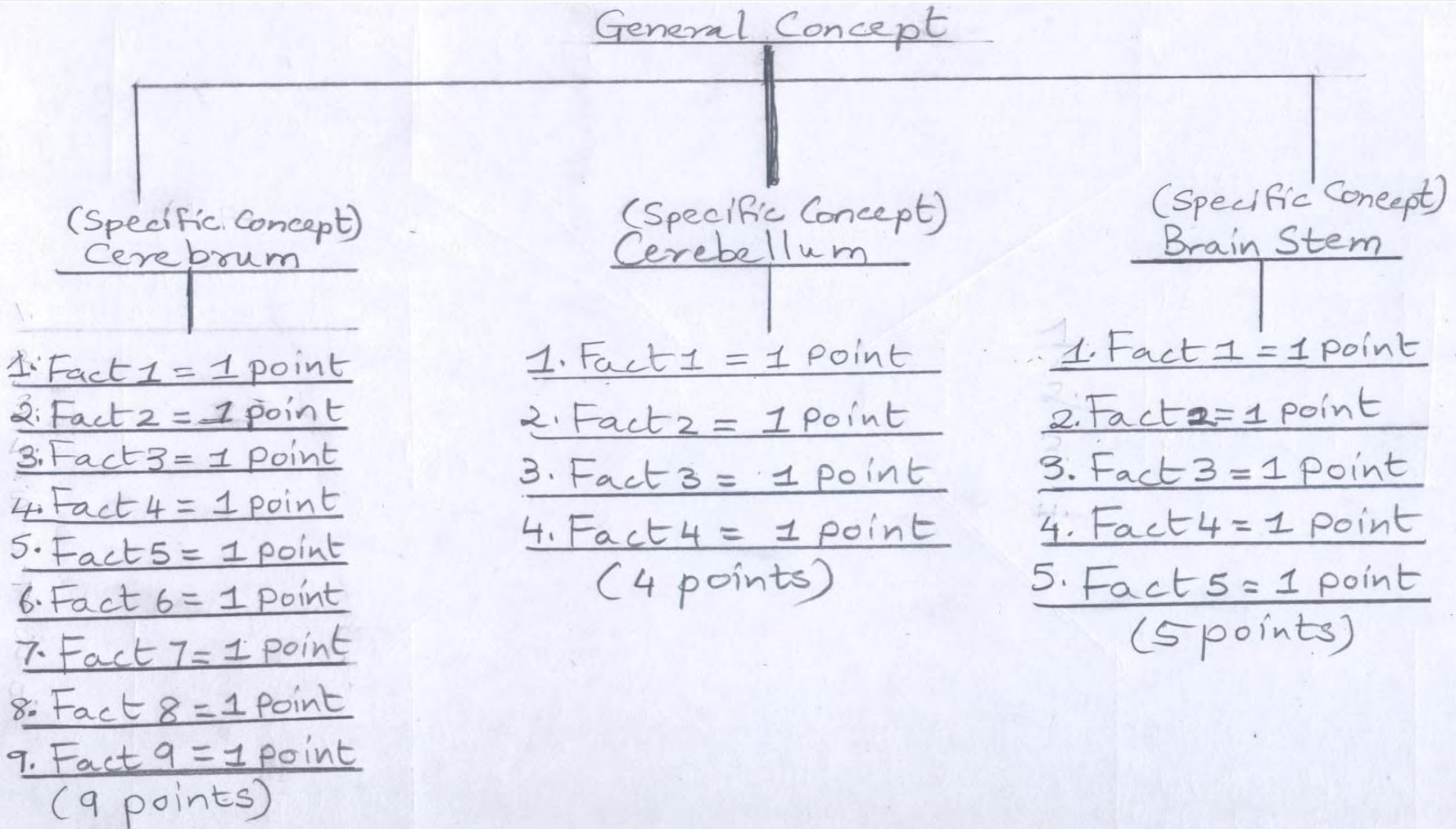
3. What is the difference between fish that are parasites and predators?

Parasites attach to fish and feed off of their blood. Predators hunt and kill their prey.

Fish: Summary

There are many different types of fish. For instance jawless fish and cartilaginous fish. Jawless fish have round, toothed mouths and long tubelike bodies covered with slimy skin. They attach to other fish with ^{their} suckerlike mouths. Cartilaginous fish have movable jaws and bodies covered with tiny scales that feel like sandpaper.

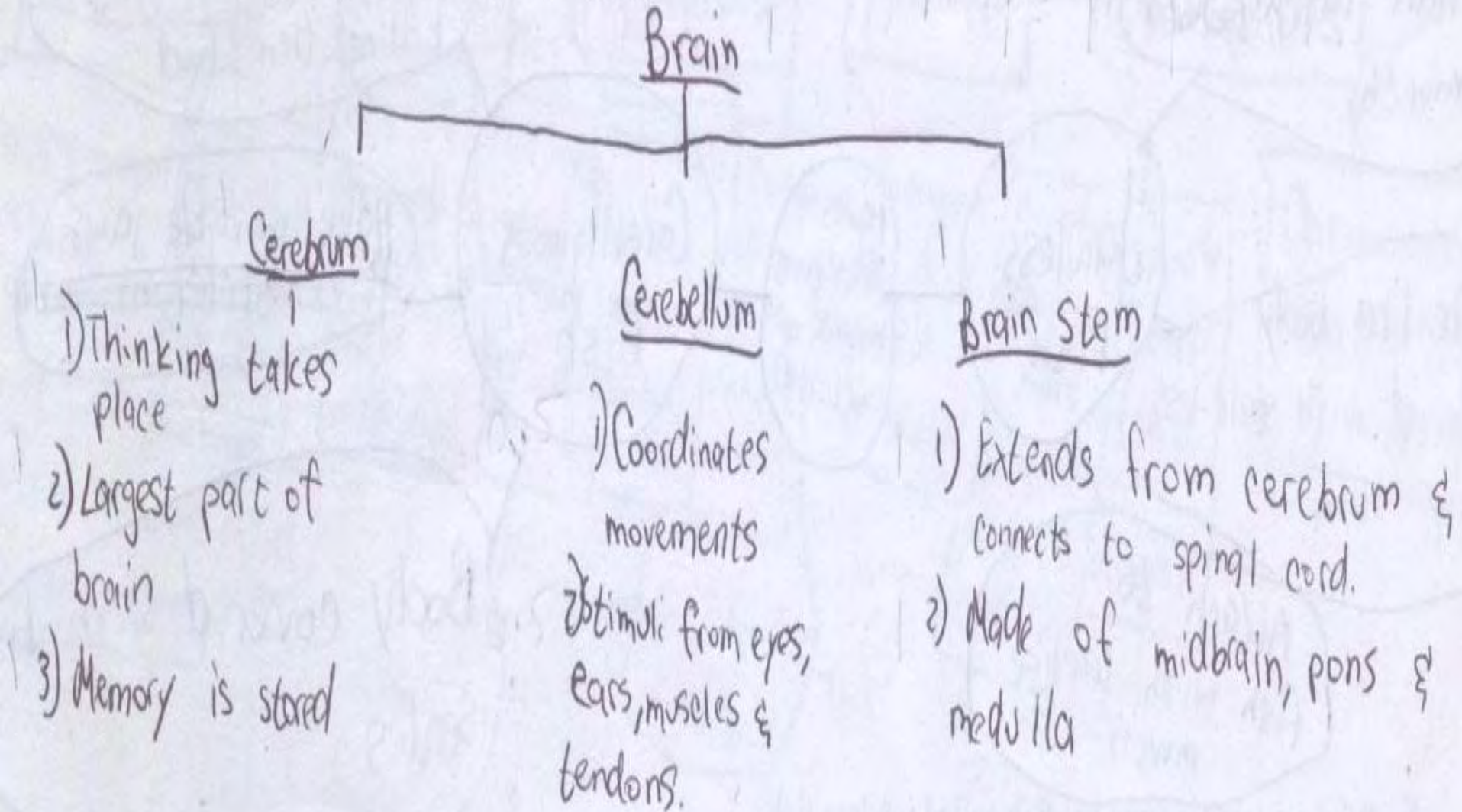
Classification: Numerical Scoring Template



Classification Map
(18 points - Brain)

Brain: Classification Map

1. Draw a classifying map to show parts of brain.



Brain: Questions

2. What major activities take place within the cerebrum?

Thinking, movements are controlled & memory is stored.

3 points

3. Why are actions controlled by the medulla involuntary actions?

Because they happen by themselves.

Brain: Summary

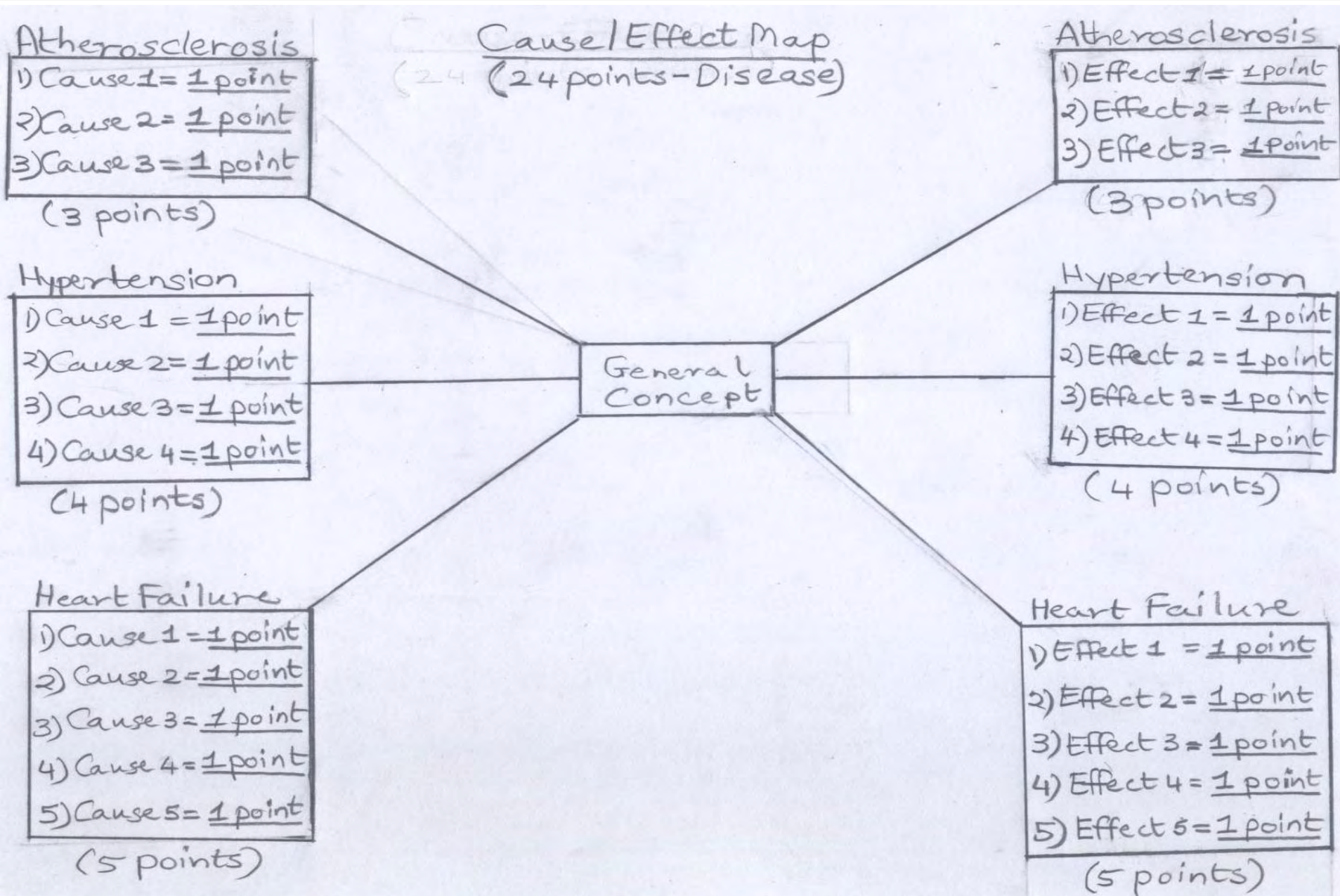
Brain

The brain is made up of three parts. These parts are called the cerebrum, the cerebellum, and the brain stem.

Thinking takes place in the cerebrum. The cerebellum is able to coordinate voluntary muscle movements.

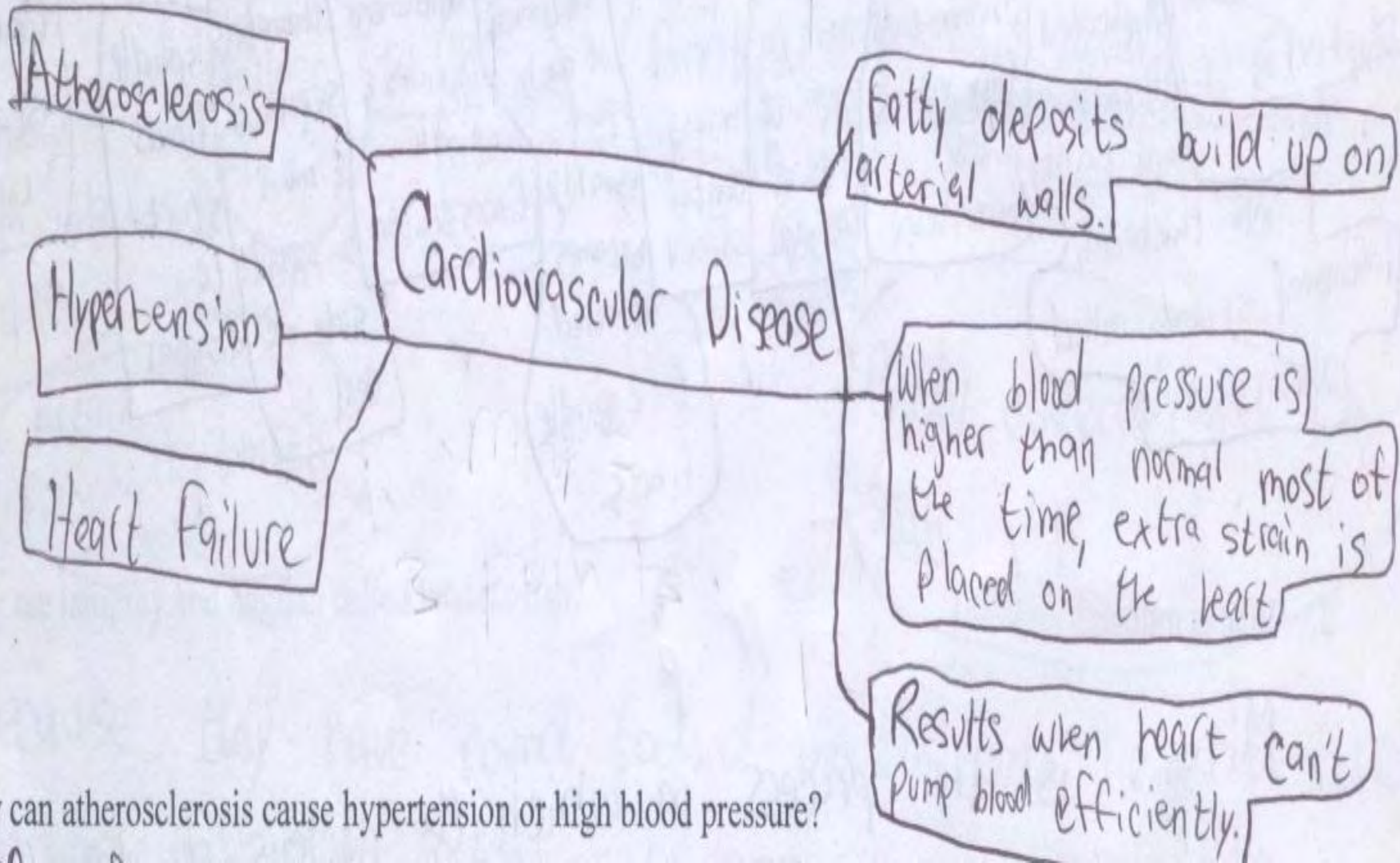
The brain stem extends from the cerebrum down to the spinal cord.

Cause/Effect: Numerical Scoring Template



Disease: Cause-Effect Map

1. Draw a multi-flow map to show causes and effects of cardiovascular disease.



2. How can atherosclerosis cause hypertension or high blood pressure?

Disease: Questions

2. How can atherosclerosis cause hypertension or high blood pressure?

Pump blood ef

If fatty deposits build up on arterial walls.

3. What are the symptoms of a heart failure?

Shortness of breath and if they are tired.

Disease: Summary

Cardiovascular Disease

(1) Atherosclerosis, Hypertension, ^{and} Heart failure are all part of Cardiovascular disease. They each do something bad to the heart. The Atherosclerosis is when fat deposits build up on arterial walls. Hypertension is when your blood pressure is higher than normal and Heart failure is when the heart cannot pump blood efficiently. These are all bad causes to the heart.

Assessment Phase: Student Performance

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
							Lower Bound	Upper Bound
Concept maps	Eighth grade students	mastery level	5	36.8000	5.8907	2.6344	29.4859	44.1141
		non-mastery level	5	25.2000	5.9330	2.6533	17.8334	32.5666
		Total	10	31.0000	8.2731	2.6162	25.0818	36.9182
Comprehension questions	Eighth grade students	mastery level	5	8.6000	1.9494	.8718	6.1796	11.0204
		non-mastery level	5	5.2000	2.7749	1.2410	1.7546	8.6454
		Total	10	6.9000	2.8848	.9123	4.8363	8.9637
Science passage summary	Eighth grade students	mastery level	5	23.4000	7.6354	3.4147	13.9195	32.8805
		non-mastery level	5	18.4000	2.0736	.9274	15.8253	20.9747
		Total	10	20.9000	5.8963	1.8646	16.6820	25.1180

Concept Mapping Intervention: Conclusions

□ Strengths

- Concept mapping helped students understand science content information
- Concept mapping helped students summarize science content information
- Concept mapping helped students identify and connect science concepts

□ Limitations

- Concept map structure limited **students' ability to identify and connect all science concepts**
 - Concept map had limited impact on **students' ability to infer about concepts**
 - Concept maps had limited impact on **students' summaries**
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END OF PRESENTATION

THANK YOU