MAPPING STRATEGIES – CHARACTERISTICS AND IMPLEMENTATION CONCEPT MAPPING, GRAPHIC ORGANIZERS, BRAIN BASED LEARNING

**Brain-based learning**

**Brain-based learning** refers to teaching methods, lesson designs, and school programs that are based on the latest scientific research about how the brain learns, including such factors as cognitive development—how students learn differently as they age, as they grow, and mature socially, emotionally, and cognitively. **Brain-based learning,** refer to instructional techniques that are grounded in the neuroscience of learning—i.e., scientific findings are used to inform educational strategies and programs.

## Brain-Based Education is the purposeful engagement of strategies that apply to how our brain works in the context of education.This learning theory is based on the structure and function of the brain. As long as the brain is not prohibited from fulfilling its normal processes, learning will occur.

**The core principles of brain-based learning state that**

1. The brain is a parallel processor, meaning it can perform several activities at once, like tasting and smelling.

2. Learning engages the whole physiology.

3. The search for meaning is innate.

4. The search for meaning comes through patterning.

5. Emotions are critical to patterning.

6. The brain processes wholes and parts simultaneously.

7. Learning involves both focused attention and peripheral perception.

8. Learning involves both conscious and unconscious processes.

9. We have two types of memory: spatial and rote.

10. We understand best when facts are embedded in natural, spatial memory.

11. Learning is enhanced by challenge and inhibited by threat.

12. Each brain is unique.

**The three instructional techniques associated with brain-based learning**

1. Orchestrated immersion–Creating learning environments that fully immerse students in an educational experience

2. Relaxed alertness–Trying to eliminate fear in learners, while maintaining a highly challenging environment

3. Active processing–Allowing the learner to consolidate and internalize information by actively processing it

**HOW BRAIN-BASED LEARNING IMPACTS EDUCATION**

1. Curriculum–Teachers must design learning around student interests and make learning contextual.
2. Instruction–Educators let students learn in teams and use peripheral learning. Teachers structure learning around real problems, encouraging students to also learn in settings outside the classroom and the school building.
3. Assessment–Since all students are learning, their assessment should allow them to understand their own learning styles and preferences. This way, students monitor and enhance their own learning process.

**Three interactive elements are essential to this process:**

• Teachers must immerse learners in complex, interactive experiences that are both rich and real. One excellent example is immersing students in a foreign culture to teach them a second language. Educators must take advantage of the brain’s ability to parallel process.

• Students must have a personally meaningful challenge. Such challenges stimulate a student’s mind to the desired state of alertness.

• In order for a student to gain insight about a problem, there must be intensive analysis of the different ways to approach it, and about learning in general. This is what’s known as the “active processing of experience.”

**A few other tenets of brain-based learning include:**

1. Feedback is best when it comes from reality, rather than from an authority figure.
2. People learn best when solving realistic problems.
3. Because every brain is different, educators should allow learners to customize their own environments.
4. Designers of educational tools must be artistic in their creation of brain-friendly environments.
5. Instructors need to realize that the best way to learn is not through lecture, but by participation in realistic environments that let learners try new things safely.

**Graphic organizers**

Graphic organizers (some of which are also called concept maps, entity relationship charts, and mind maps) are a pictorial way of constructing knowledge and organizing information. They help the student convert and compress a lot of seemingly disjointed information into a structured, simple-to-read, graphic display. The resulting visual display conveys complex information in a simple-to-understand manner.

 A graphic organizer is a visual and graphic display that depicts the relationships between facts, terms, and or ideas within a learning task. Graphic organizers are also sometimes referred to as knowledge maps, concept maps, story maps, cognitive organizers, advance organizers, or concept diagrams.

**Why Are Graphic Organizers Used?**

**Graphic organizers** help students organize ideas, see relationships, and retain information. Visual representations can be used in all disciplines and are quite flexible in their application. How graphic organizers are used depends on the objective. The process of converting a mass of data/information/ideas into a graphic map gives the student an increased understanding and insight into the topic at hand. To create the map, the student must concentrate on the relationships between the items and examine the meanings attached to each of them. While creating a map, the student must also prioritize the information, determining which parts of the material are the most important and should be focused upon, and where each item should be placed in the map.

The creation of graphic organizers also helps the student generate ideas as they develop and note their thoughts visually. The possibilities associated with a topic become clearer as the student's ideas are classified visually.

**Types of graphic organizers**

1.  [**Star**](http://www.enchantedlearning.com/graphicorganizers/star/): If the topic involves investigating attributes associated with a single topic, use a star diagram as your graphic organizer. Example: Finding methods that help your study skills (like taking notes, reading, doing homework, memorizing, etc.)
2. [**Spider**](http://www.enchantedlearning.com/graphicorganizers/spider/): If the topic involves investigating attributes associated with a single topic, and then obtaining more details on each of these ideas, use a spider diagram as your graphic organizer. This is like the star graphic organizer with one more level of detail. Example: Finding methods that help your study skills (like taking notes, reading, memorizing, etc.), and investigating the factors involved in performing each of the methods.

1. [**Fishbone**](http://www.enchantedlearning.com/graphicorganizers/fishbone/): If the topic involves investigating multiple cause-and-effect factors associated with a complex topic and how they inter-relate, use a fishbone diagram as your graphic organizer. Example: Examining the effects of improved farming methods.



1. [**Cloud/Cluster**](http://www.enchantedlearning.com/graphicorganizers/cloud/): If the topic involves generating a web of ideas based on a stimulus topic, use a clustering diagram as your graphic organizer. Example: brainstorming.



1. [**Tree**](http://www.enchantedlearning.com/graphicorganizers/tree/): If the topic involves a chain of events with a beginning and with multiple outcomes at each node (like a family tree), use a tree as your graphic organizer. Example: Displaying the probabilistic results of tossing coins.
2. [**Chain of Events**](http://www.enchantedlearning.com/graphicorganizers/chain/): If the topic involves a linear chain of events, with a definite beginning, middle, and end, use a chain of events graphic organizer. Example: Analyzing the plot of a story.
3. [**Continuum/Timeline**](http://www.enchantedlearning.com/graphicorganizers/timeline/): If the topic has definite beginning and ending points and a number of divisions or sequences in between, use a continuum/timeline. Example: Displaying milestones in a person's life.
4. [**Clock**](http://www.enchantedlearning.com/graphicorganizers/clock/): If the topic involves a clock-like cycle, use a clock graphic organizer. Example topic: Recording the events in a typical school day or making a story clock to summarize a story.
5. [**Cycle of Events**](http://www.enchantedlearning.com/graphicorganizers/cycle/): If the topic involves a recurring cycle of events, with no beginning and no end, use a cyclic graphic organizer. Example topic: Documenting the stages in the lifecycle of an animal.
6. [**Flowchart**](http://www.enchantedlearning.com/graphicorganizers/flowchart/): If the topic involves a chain of instructions to follow, with a beginning and multiple possible outcomes at some node, with rules at some nodes, use a flowchart. Example: Computer programmers sometimes use flowcharts to organize the algorithm before writing a program.
7. [**Venn Diagram**](http://www.enchantedlearning.com/graphicorganizers/venn/): If the task involves examining the similarities and differences between two or three items, use a Venn diagram. Example: Examining the similarities and differences between fish and whales, or comparing a book and the accompanying movie.
8. [**Chart/Matrix Diagram**](http://www.enchantedlearning.com/graphicorganizers/chart/): If the task involves condensing and organizing data about traits of many items, use a chart/matrix. Example: Creating a display of key inventions, who invented them, when, where and why they were invented, etc.
9. [**T-Chart Diagram**](http://www.enchantedlearning.com/graphicorganizers/tchart/): If the task involves analyzing or comparing with two aspects of the topic, use a T-Chart. Example: Fill out a T-Chart to evaluate the pros and cons associated with a decision.
10.  [Fact/Opinion](http://www.enchantedlearning.com/graphicorganizers/fact/): If the task involves distinguishing the facts vs. the opinions in a theme or text, use fact/opinion charts. Example: Fill out a fact/opinion chart to evaluate the facts and opinions presented in a news article.
11. [PMI Diagram](http://www.enchantedlearning.com/graphicorganizers/pmi/): If the task involves analyzing the plusses, minuses, and implicatios of a decision or an action, use a PMI Chart. Example: Fill out a PMI Chart to help evaluate the positive, negative and interesting points associated with taking a new job.
12. [Decision Making Diagrams](http://www.enchantedlearning.com/graphicorganizers/decision/): If the task is making a decision, use a graphic organizer to enumerate possible alternatives and the pros and cons of each. Example: Fill out a desicion making diagram to help decide which elective courses you'd like to take next quarter.
13. [Semantic Feature Analysis Charts](http://www.enchantedlearning.com/graphicorganizers/sfa/): If the task is comparing characteristics among a group of items, use Semantic Feature Analysis . Example: Fill out a Semantic Feature Analysis chart to compare and contrast the care needed for various pets.
14. [Cause and Effect Diagrams](http://www.enchantedlearning.com/graphicorganizers/causeandeffect/): If the task is examining possible causes and effects in a process, use a cause and effect graphic organizer . Example: Fill out a cause-and-effect diagram to trace the steps in a feedback loop..
15. [KWHL Diagram](http://www.enchantedlearning.com/graphicorganizers/KWHL/): If the task involves analyzing and organizing what you know and what you want to learn about a topic, use a KWHL chart. K stands for what you already KNOW about the subject. W stands for what you WANT to learn. H stands for figuring out HOW you can learn more about the topic. L stands for what you LEARN as you read. Example: Fill out a KWHL chart before, during, and after you read about a topic.
16. [Pie Charts](http://www.enchantedlearning.com/graphicorganizers/piechart/): If the task involves showing divisions with a group, use a pie chart. Example: Draw a pie chart to show what percentages of a population have blue eyes, green eyes, or brown eyes.
17. [Vocabulary Map](http://www.enchantedlearning.com/graphicorganizers/vocab/): Graphic organizers can be useful in helping a student learn new vocabulary words, having them list the word, its part of speech (noun, verb, adjective, adverb, etc.), a synonym, an antonym, a drawing that represents the word, and a sentence using the word.
18. [Paragraph Structure](http://www.enchantedlearning.com/graphicorganizers/paragraph/): These graphic organizers help you organize the structure of a paragraph, including a topic sentence, sentences with support details, and a conclusion sentence.
19. [5 W's Diagram](http://www.enchantedlearning.com/graphicorganizers/5ws/): If the task involves analyzing the Five W's (Who, When, Where, What, and Why) of a story or event. Example: Fill out a 5 W's Chart to help evaluate and understand the major points of a newspaper story.
20. [Story Map](http://www.enchantedlearning.com/graphicorganizers/storymap/): Story maps can help a student summarize, analyze and understand a story or event.
21. [Character Traits](http://www.enchantedlearning.com/graphicorganizers/character/): Graphic organizers help the student identify the traits of fictional characters by looking at events surrounding the character in the text.

1. [Biography Diagrams](http://www.enchantedlearning.com/graphicorganizers/biography/) Graphic organizers are useful to help prepare for writing a biography. Before writing, the graphic organizer prompts the student to think about and list the major events in the person's life.

1. [Animal Report Diagrams](http://www.enchantedlearning.com/graphicorganizers/animalrpt/): Many graphic organizers are useful to help prepare for writing a report on animals. Before writing, the student should think about and list the major topics that will be researched and covered in the report.
2. [Geography Report Diagrams](http://www.enchantedlearning.com/graphicorganizers/geography/): These graphic organizers are useful to for doings a short report on a country or other area. The student draws a map and flag, and looks up basic information on the area.
3. [Math Diagrams](http://www.enchantedlearning.com/graphicorganizers/math/): Many graphic organizers are useful to learn and do math, include Venn diagrams, star diagrams, charts, flowcharts, trees, etc.
4. [Scientific Method Diagrams](http://www.enchantedlearning.com/graphicorganizers/scientificmethod/): Graphic organizers used to prepare and organize a scientific experiment.

**CONCEPT MAPPING**

**Definition of a Concept Map**

A concept map is a type of [**graphic organizer**](http://www.inspiration.com/inspiration-socialstudies-examples) used to help students organize and represent knowledge of a subject. Concept maps begin with a main idea (or concept) and then branch out to show how that main idea can be broken down into specific topics.

Concept maps are graphical tools for organizing and representing knowledge.

 They include **concepts**, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line, referred to as **linking words*or*linking phrases*,*** specify the relationship between the two concepts. We defineconcept*as a*perceived regularity or pattern in events or objects, or records of events or objects, designated by a label*.* The label for most concepts is a word, although sometimes we use symbols such as + or %, and sometimes more than one word is used. **Propositions** are statements about some object or event in the universe, either naturally occurring or constructed. Propositions contain two or more concepts connected using linking words or phrases to form a meaningful statement. Sometimes these are called **semantic units, or units of meaning.**



In the Figure, "Concept Maps", "Organized Knowledge", and "Focus Question(s)" are **concepts,** "represent", "needed to answer" are **linking words**, and together they form the two **propositions**: 1) "Concept Maps represent Organized Knowledge", and 2) "Organized Knowledge <is> needed to answer Focus Question(s)".

“A concept map is a graphical representation where nodes (points or vertices) represent concepts, and links (arcs or lines) represent the relationships between concepts. The concepts, and sometimes the links, are labeled on the concept map. The links between the concepts can be one-way, two-way, or non-directional. The concepts and the links may be categorized, and the concept map may show temporal or causal relationships between concepts”.

###### **Theoretical Foundation**

Concept maps have a strong psychological and epistemological foundations, based on Ausubel's Assimilatioin Theory (Ausubel, 1968, 2000) and Novak's Theory of Learning, which explain that people learn new things by using their current knowledge and, to a greater or lesser degree, seeking ways to integrate new knowledge and related knowledge already known. When learning meaningfully, the integration of new concepts into our cognitive knowledge structure takes place through linking this new knowledge to concepts we already understand. Thus a concept map is a graphical representation of these relationships between concepts in our cognitive structure.

### Purpose of concept mapping

Concept mapping can be used for several purposes:

--To generate ideas (brainstorming);

--To design complex structures (long texts, hypermedia, large web sites);

--To communicate complex ideas;

--To aid learning by explicitly integrating new and old knowledge; and

--To assess understanding or diagnose misunderstanding.

**How to Build a Concept Map**

Concept maps are typically hierarchical, with the subordinate concepts stemming from the main concept or idea. This type of graphic organizer however, always allows change and new concepts to be added. The Rubber Sheet Analogy states that concept positions on a map can continuously change, while always maintaining the same relationship with the other ideas on the map.

* **Start with a main idea, topic, or issue to focus on.**

A helpful way to determine the context of concept map is to choose a focus question—something that needs to be solved or a conclusion that needs to be reached. Once a topic or question is decided on, that will help with the hierarchical structure of the concept map.

* **Then determine the key concepts**

Find the key concepts that connect and relate to your main idea and rank them; most general, inclusive concepts come first, then link to smaller, more specific concepts.

* **Finish by connecting concepts--creating linking phrases and words**

Once the basic links between the concepts are created, add cross-links, which connect concepts in different areas of the map, to further illustrate the relationships and strengthen student’s understanding and knowledge on the topic.

**Some of the key characteristics of concept maps.**

###### **1. Propositional Structure**

Concept maps express explicitly the most relevant relationships between a set of concepts. This relationship is depicted by means of the linking phrases forming propositions. E.g., in Figure 1, the relationship between concepts "Organized Knowledge" and "Concepts" is expressed through the linking words "is comprised of", forming the proposition "Organized Knowledge is comprised of Concepts". The same linking words are part of the proposition "Organized Knowledge is comprised of Propositions". When constructing a concept map, one needs to be careful that every two concepts together with their linking phrases form a unit of meaning, a claim, a short sentence. On occasions, a proposition will span across three or more concepts, but we try to avoid this to the extent possible. Thus a concept map consists of a graphical representation of a set of propositions about a topic.

In a concept map, each concept consists of the minimum number of words needed to express the object or event, and linking words are also as concise as possible and usually include a verb. There is no predefined list of linking words. We consider that a predefined list of words would restrict the users and, even if the list is not enforced, would tempt them to select from the list instead of attempting to find the linking words that best the depict the relationship according their understanding of the domain.

###### **2. Hierarchical Structure**

Within any domain of knowledge, there is hierarchy of concepts, where the most general concepts are at the "top" of the hierarchy and the more specific, less general concepts are arranged hierarchically below. Concept maps tend to be represented in a graphically hierarchical fashion following this conceptual hierarchy. In the Figure, the most general concepts "Concept Maps", "Focus Question(s)", "Associated Feelings or Affect" are close to the top of the hierarchy as they are more 'general' within the context of concept mapping, while "Infants", "Creativity" and "Experts" are further down the hierarchy. Because of this, concept maps tend to be read from the top, progressing down towards the bottom. Note that this doesn't mean that a concept map needs to have a graphically hierarchical structure: a concept map about the water cycle could be cyclic, while there is a still conceptual hierarchy of precedence or cause and effect in the concept map. Neither does it mean that concept maps need to have only one "root" concept -- their could be more than one. However, we have found that when learning to build concept maps, keeping the concept maps hierarchal with a single root makes it easier for the learner to grasp how concept maps are constructed.

###### **Focus Question**

A good way to delineate the context for a concept map is to define a Focus Question, that is a question that clearly specifies the problem or issue, the concept map should help to resolve. Every concept map responds to a focus question, and a good focus question can lead to a much richer concept map. When learning to construct concept maps, learners tend to deviate from the focus question and build a concept map that may be related to the domain, but which does not answer the question. This is fine in the sense that the map built probably answers another focus question, and so the focus question of the map should be changed to reflect this. In the case of a school-learning environment, it may be important to have the learner go back and construct a concept map that responds the original focus question.

###### **Cross-Links**

Another important characteristic of concept maps is the inclusion of cross-links. These are relationships or links between concepts in different segments or domains of the concept map. Cross-links help us see how a concept in one domain of knowledge represented on the map is related to a concept in another domain shown on the map. In the creation of new knowledge, cross-links often represent creative leaps on the part of the knowledge producer. There are two features of concept maps that are important in the facilitation of creative thinking: the hierarchical structure that is represented in a good map and the ability to search for and characterize new cross-links. In Figure, the concept "Creativity" is linked to both "Infants" and "Interrelationships", each of which are in separate sub domains of the concept map, forming cross-links.

###  ADVANTAGES OF CONCEPT MAPPING

* Helping students brainstorm and generate new ideas
* Encouraging students to discover new concepts and the propositions that connect them
* Allowing students to more clearly communicate ideas, thoughts and information
* Helping students integrate new concepts with older concepts
* Enabling students to gain enhanced knowledge of any topic and evaluate the information
* Visual symbols are quickly and easily recognized
* Minimum use of text makes it easy to scan for a word, phrase, or the general idea
* Visual representation allows for development of a holistic understanding that words alone cannot convey.

### APPLICATIONS OF CONCEPT MAPPING

(1) Creativity Tool: Drawing a concept map can be compared to participating in a brainstorming session. As one puts ideas down on paper without criticism, the ideas become clearer and the mind becomes free to receive new ideas. These new ideas may be linked to ideas already on the paper, and they may also trigger new associations leading to new ideas.

(2) Hypertext Design Tool: As the World Wide Web becomes an increasingly powerful and ubiquitous medium for disseminating information, writers must move from writing text in linear fashion to creating hypertext documents with links to other documents. The structural correspondence between hypertext design and concept maps makes concept mapping a suitable tool for designing the conceptual structure of hypertext. The structure of both a hypertext document and a concept map can be seen as a directed graph or a knowledge graph. A concept map placed on the Web in hypertext may also serve as a Web navigational tool if there are clickable areas on the concept map that take the user immediately to indicated parts of the hypertext document.

 (3) Communication Tool: A concept map produced by one person represents one possible way to structure information or ideas. This is something that can be shared with others. A concept map produced by a group of people represents the ideas of the group. In either case, concept mapping can be used as a communication tool for people to use to discuss concepts and the relationships between the concepts. They may try to agree on a common structure to use as a basis for further action.

(4) Learning Tool: Constructivist learning theory argues that new knowledge should be integrated into existing structures in order to be remembered and receive meaning. Concept mapping stimulates this process by making it explicit and requiring the learner to pay attention to the relationship between concepts. Jonassen (1996) argues that students show some of their best thinking when they try to represent something graphically, and thinking is a necessary condition for learning.

(5) Assessment Tool: Concept maps can also be used as assessment tools. The conceptions students may have are often incomplete and deficient leading to misunderstanding of instruction. Concept maps drawn by students express their conceptions (or their misconceptions) and can help the instructor diagnose the misconceptions that make the instruction ineffective.