Concept Mapping

General

Concept mapping is a cognitivist instructional design model developed by Joseph Novak and his colleagues in 1972 as they worked on understanding how children's knowledge of science changes[1]. Some of the first concept maps were, however, proposed by some other authors as well[2], but concept maps in their fullest form were introduced by Novak in 1981[3]. In Novak's words, concept map is a

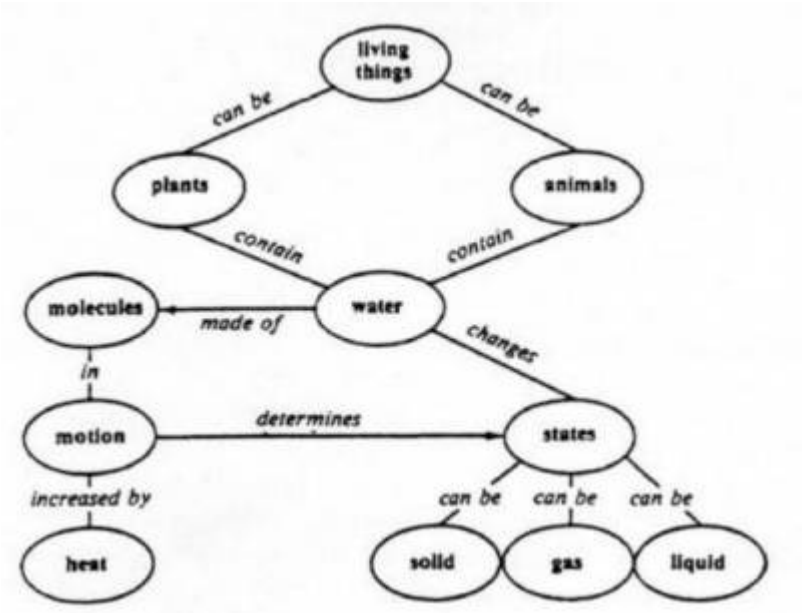
- "***visual representation of the relationships between concepts*** *held by an individual, materials of a lecture, textbook, or laboratory exercise. By concept mapping even old and familiar material, we often recognize new relationships and meaning.*"[4]

Novak's ideas were influenced by David Ausubel's assimilation theory and his hierarchical knowledge structure suggestions[5].

What is concept mapping?

Concept mapping is the process of creating concept maps,

- "*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 define concept as a perceived regularity in events or objects, or records of events or objects, designated by a label.*"[6]



As explained, on the visual level, a concept map is a hierarchical (general to specific) diagram containing nodes and links, both labeled with words or symbols. The most important concept is usually placed in the center of the map or at its top. Novak describes the concept map building process in following steps[7]:

1.	**Identify key concepts** of the material and list them or write them on pieces of paper to make them movable.
2.	**Rank concepts** by placing most general ones at the top of the map with respect to the context of the matherial.
3.	**Add other more specific concepts** under the more inclusive ones.
4.	**Connect concepts** by labeled lines. Labels should add meaning by defining relationships between connected concepts.
5.	If desired, **specific examples** of concepts can also be added below concept labels.
6.	If desired, change or reorganize the map in accordance with the newly noted relations between the concepts. Concept maps for the same topic can be organized in more possible ways.

Concepts maps can be useful to both teachers and students. A teacher can use them to[8)]:

- **identify and organize concepts** he is about **to teach**,
- gain **insight to what the students already know** or how they view the topic from concept maps drawn by the students, so he knows what should be taught next,
- teach terms, facts, and concepts of given topic,
- organize information into meaningful categories and relate those categories on a more general level,
- synthesize and integrate learned information thereby strengthening long-term retention, and
- develop creativity and higher-level thinking skills, strategies, and habit.

To students concept maps give the ability to[9)]:

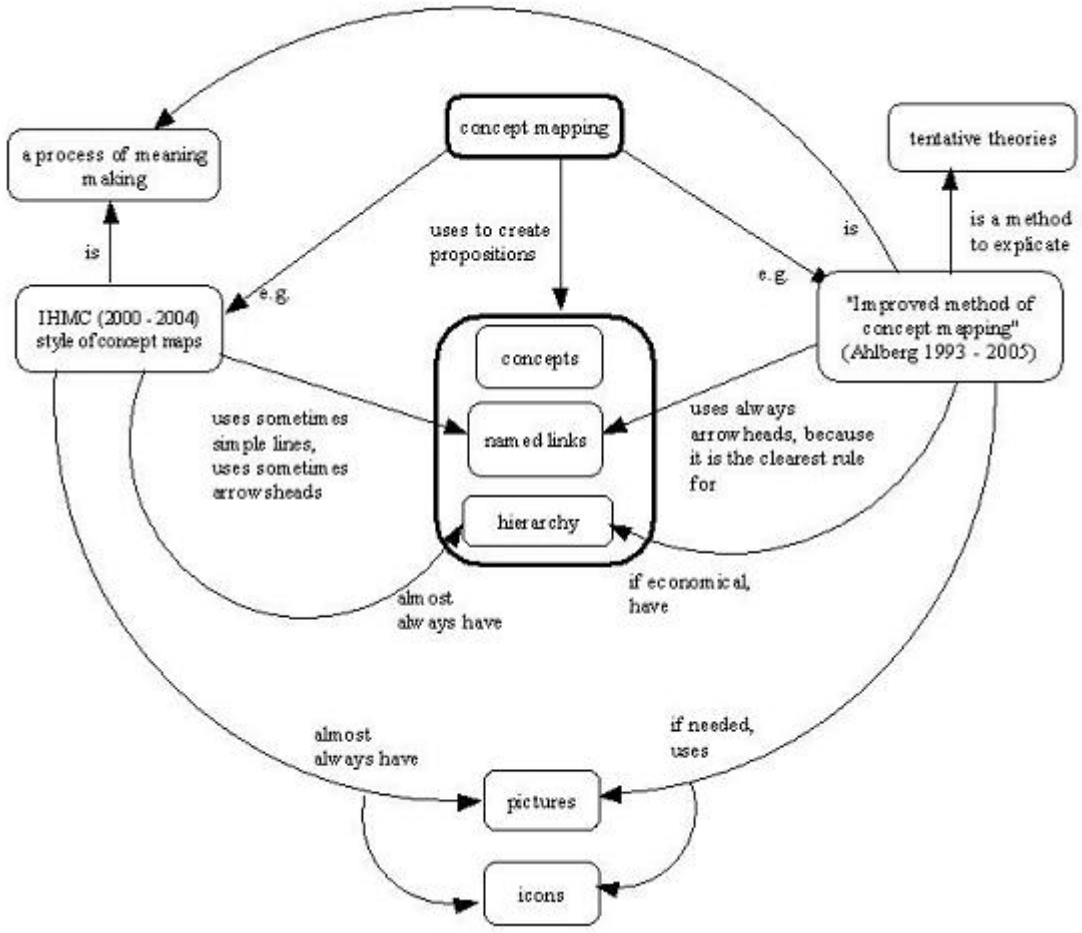
- **organize** and **assess** their own knowledge, and
- learn through **adding new concepts to the existing framework** of the concept map.

This process is, according to Novak[10)], often accompanied by positive feelings. A step-by-step example on how to introduce and work on concept maps with students in classes can be found in Michael Zeilik's article on concept mapping.

Another important property of concept maps is that learning through adding new concept to them is inherently **meaningful learning**, since it establishes clear connections with the existing knowledge. **Rote learning** on the other hand is the result of **lack of established connections** to prior knowledge and forgetting of the learned information in 4-6 weeks[11)].

Concept mapping presents the process of building concept maps. In order to successfully build concept maps, their terminology needs to be clarified. Novak defines **concepts** as **patterns or regularities** in objects (*things*) or events (*happenings*).[12)]

For example, the *concept* “dog” is formed by a set of common characteristics of dogs. “Chihuahua”, a specific kind of dog, would here be an *object*. Every person has a different “dog” concept since the set of common characteristics forming it may vary from person to person and generally depends on experience, context and perspective. Still, these concepts are usually similar enough to enable people to successfully communicate and think in terms of concepts and change them over time.



A set of improvements to concept mapping has been suggested by Ahlberg[13]:

- all **concepts** are interpreted as main elements and should be **inside frames**, which was not the case in Novak's earlier works
- there are **no limits on the length of the labels** since longer labels are sometimes required to offer accurate explanation
- connections should have **arrowheads** in order to point the direction of the connection
- **pictures, videos or sounds** may also be connected in a concept map
- concept mapping is a **general method for knowledge representation** and does not have to be associated exclusively with Ausubel's assimilation theory
- concept maps do **not** have to be **hierarchical** (for example cyclic concept maps[14])
- a good concept map should have only **one instance of each concept**, which was not the rule in some Novak's works, sometimes due to a too large number of links connecting a certain concept
- sometimes it is useful to suggest a way of reading a concept map (for example top to bottom or bottom to top)

Concept maps were earlier drawn by hand, but today a number of computer applications like the free IHMC CmapTools can be used to enhance this process.

Criticisms

Concept mapping is a very well accepted and widely used method, but it:

- was designed mostly to represent declarative and **not procedural knowledge** or algorithms,
- is a rather **difficult** and sometimes **time-consuming cognitive task** which requires training, and
- there is no standardized way of scoring/comparing concept maps[15].

Keywords and most important names

- **Concept mapping**, **concept maps**, **concept**, **object**, **meaningful learning**
- Joseph Novak

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Read more

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