

# CRITERIA AND RATIONALE FOR GOOD CONCEPT MAPS

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## DEFINITIONS:

**A CONCEPT IS A PERCEIVED REGULARITIES OR PATTERNS IN EVENTS OR OBJECTS, OR REPRESENTATIONS OF EVENTS OR OBJECTS, LABELED BY A WORD OR SYMBOL.**

**A PROPOSITIONS IS TWO OR MORE CONCEPTS LINKED WITH WORDS TO FORM A STATEMENT ABOUT HOW SOME ASPECT OF THE UNIVERSE APPEARS OR ACTS. PROPOSITIONS ARE THE UNITS OF MEANING IN MEANINGFUL LEARNING AND FORM THE STRUCTURE OF A DOMAIN OF KNOWLEDGE WHEN WELL ORGANIZED AND INTEGRATED.**

**1. A *context* for the concept map should be defined, commonly with a stated explicit “focus question”.**

Concept maps are very helpful for organizing the knowledge needed to find solutions to problems or questions. These may derive from a topic of study, or some form of inquiry. The *focus question* helps to give focus on the knowledge that is most relevant to the problem or question. Stating an explicit question can be very helpful in identifying the best concepts to include at the top level of a concept map. In turn, identifying the best concepts to include at the top of a map often leads to better focus question. When working in group settings, the process of identifying a good focus question and the 6 – 10 *top level* concepts may take half as much time as constructing the initial concept map. A good focus question helps to define clearly the context we are working in and aids in the process of concept mapping the knowledge pertinent to that context. The focus question may appear as the top node of a concept map, or as a header for the map

**2. Concept labels in maps should be only one or a few words labeling a specific concept.**

Concept labels represent *perceived regularities or patterns in events or objects, or transformations of records of events or objects, designated by a label*. Usually the label is a word or a few words, e.g., history, medieval history, disease, or heart attack. Usually when more than one word is used to label a concept, one must consider if some of the words in the label are also labels for other concepts and should be indicated as separate concepts in a map. Only rarely is a concept indicated by several words. When sentences of longer phrases appear as a node label in a concept map, a *submap* might be more appropriately included, showing the structure of knowledge represented by the sentence or phrase.

**3. Linking lines should be labeled with one or few words, and not contains concepts labels important to the map's conceptual content. They specify the proposition or principle formed by the concepts and linking words.**

Linking words and the concepts linked by these words should form a meaningful statement about some event or object, or class of events or objects. More specific linking words give more explicit meaning to the relationship between two concepts, and these are often preferred to more generic linking words such as: is a, are, includes, related to, etc. More specific links may include words such as requires, composed of, derived from, etc. The degree of understanding of a given domain of knowledge is indicated in the precision and or specificity of the proposition shown in the concept and linking words given in the map.

**4. Maps should have hierarchical organization, with the most general, most inclusive concept at the top, and progressive more specific, less inclusive concept at lower levels.**

There is evidence that our brains store knowledge *hierarchically* and thus organizing knowledge in this fashion helps to acquire and use knowledge more efficiently. Building a hierarchical structure also follows Assimilation Learning Theory, wherein new knowledge is most easily acquired when it is *subsumed* under existing concept and proposition in our mind. Evidence from studies of experts versus novices also indicates that acquiring expertise is usually associated with better organized, more hierarchical map structures. Building such concept maps encourages higher levels of meaningful learning, leading to longer retention of knowledge and greater ability to apply knowledge in novel settings.

**5. In general no more than three or four sub-concept should be linked below a given concept.**

Two fundamental considerations operate here: First, our *working memory* can only process efficiently 5-7 *chunks* of information at a time. Too many subordinate concepts mean that these cannot be considered simultaneously in working memory. Second, usually there are concepts of intermediate generality that can be added to a map, thus reducing the number of concepts under the superordinate concept and the more specific set of subordinate concepts. Searching for these intermediate concepts usually not only makes the map more hierarchical, but often important missing concepts or new insights in to the knowledge structure are achieved.

**6. Specific examples of objects or events may be added to maps where appropriate, but these should clearly distinguishable from concepts.**

Given the epistemology or theory of knowledge underlying concept maps, it is important to recognize the difference between *specific* events or objects and concept labels for *regularities* recognized in specific events or objects, By noting specific examples (not in boxes or other node forms) helps to clarify the kinds of events or objects that are

identified by the concept label in the mode. On the other hand, numerous examples that are not needed to clarify concept meanings results in a “cluttered” map, and thus obscure the structure of knowledge we are trying to elucidate.

**7. Cross-links should specify significant interrelationship between two concepts in different sub-domains of knowledge shown in the map. These are best added when the map is nearing completion.**

Creative insights usually result from recognition of new relationships between concepts and/or propositions in sub-domain of a given body of knowledge with those in another sub-domain. These kinds of relationships can be indicated by *cross-links* in a concept map of sufficient complexity and inclusiveness and can lead to creative insights. Partly for this reason, if we are looking for new creative insights it is important to plan to build concept maps that are hierarchically well organized and large and complex enough to optimize the chances for identifying significant cross-links, and yet not so large as to be overwhelming. Otherwise, we might better use sub-maps (accessed through icons on concepts when using CmapTools software concepts).

**8. Concept labels should not appear more than once in a given map**

The meaning of a concept is represented by all of the propositions that contain the concept in a given knowledge domain. Thus to define the meaning explicitly, it is best to use a given concept label only once in a given concept map. A map that contains the same concept two or more times can usually be restructured so that the concept only appears once. Sometimes this may require reconstruction of other sections of the map and usually this leads to general improvement of the map.

**9. Resources may be added to concept maps either on concepts or on linking words when using CmapTools software.**

Resources can be added to concept maps to provide formal definitions of concepts, specific examples, elaborate further on concept meanings, attach *sub-maps*, or attach other illustrative material. There is always the consideration of whether concept map attachments would be better shown directly as part of the map, or as an attached resource is the best form to use. This is a judgment call, and may vary depending on the primary purpose for use of the map. Any material that can be digitized may be added as a resource using CmapTools.

When resources are attached to linking words, one must always consider if the linking words or map structure should be altered instead, e.g., if significant concept words are in the link, or the resource might be better attached to a concept.

**10. Additional *global maps* may be constructed to show cross-link between concepts on superordinate and subordinate concept maps detailed and sections of the latter maps may be removed to add clarity to cross links.**

As noted in #7, cross links can be useful in obtaining creative insights, and these may be best seen on more general, more *global* concept maps. Also for orientation purpose with a given audience, simpler *global* maps can be useful, especially when the audience is relatively unfamiliar with the knowledge domain represented. Color coding may also be helpful to show relationships on global concept maps.