CONCEPT MAPPING

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Definition

- **“Concept maps are intended to represent meaningful relationship between concepts in the form of propositions”**
  - Novak JD, Learning how to learn,1984

Definition

- Schematic device for organizing and representing knowledge structures as a set of concept meanings related to one another

Theoretical framework

- Ausubel :*Assimilation theory*
  - When thinking and learning with concepts, an individual uses three processes:
    1. subsumption
    2. progressive differentiation
    3. integrative reconciliation.

Theoretical framework

1. Identify most general concept and more specific concepts

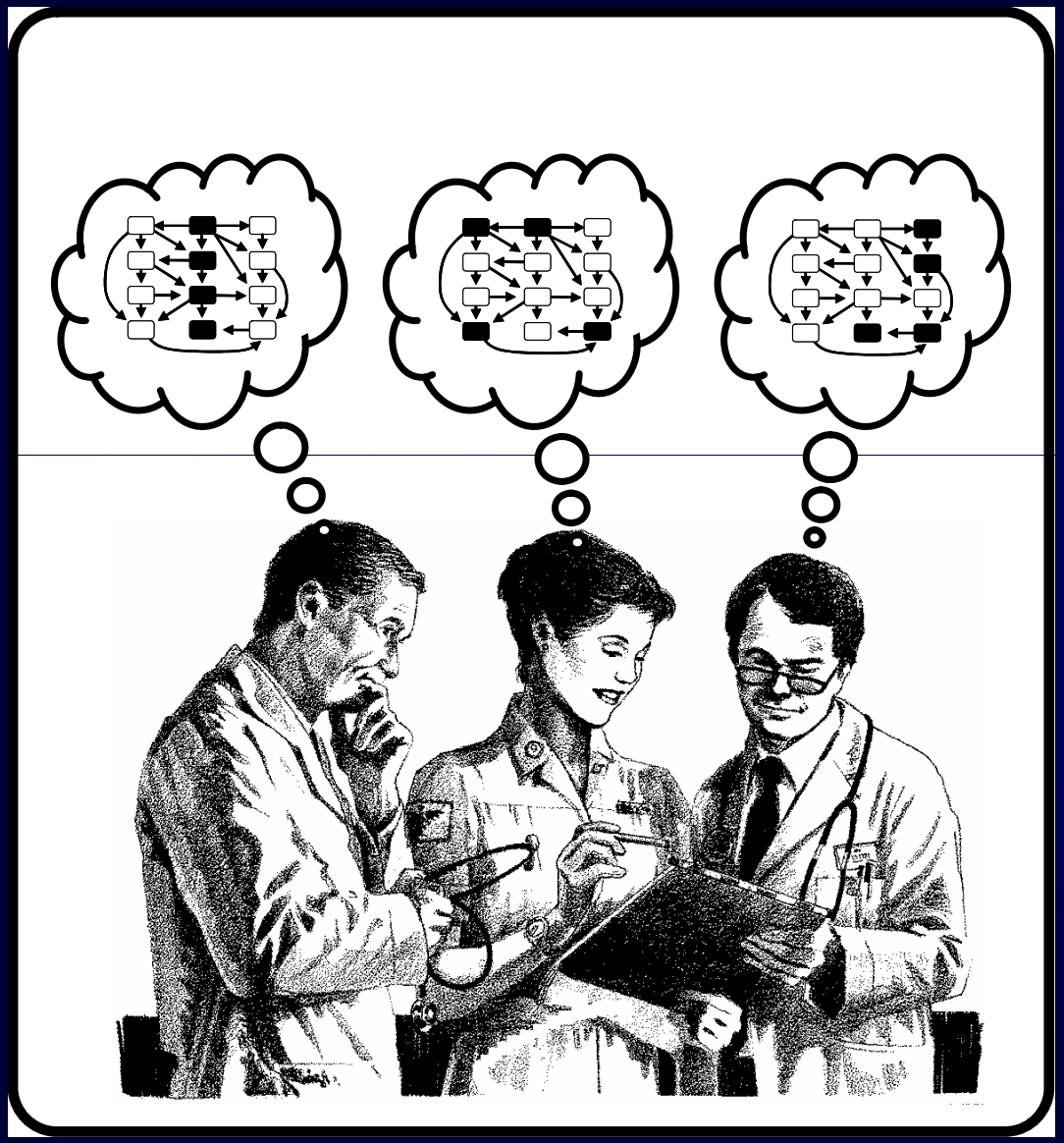
2. Relate with linking words the general to the most specific concepts

3. Seek and develop cross-links among different knowledge domains of the maps

Theoretical Framework

- We think and learn with concepts
- To build meaningful learning
  - **Constructivist/cognitivist** approach

- Meaningful learning means relating new knowledge to what we already know (Ausubel, 1968)

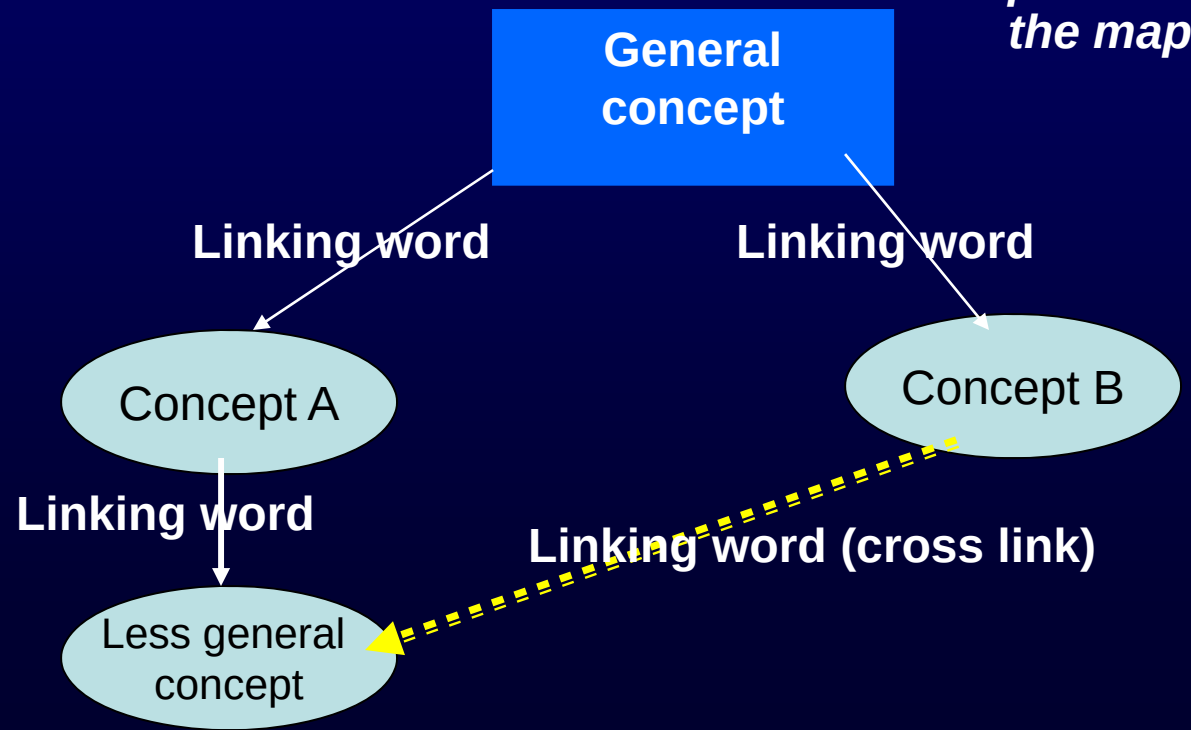


That is how we think!!!!!

Concept Maps

Concept maps are pictures or graphic representations that allow learners to **link, differentiate and relate concepts to one another**

place at the top of the map.



How to construct a concept map?

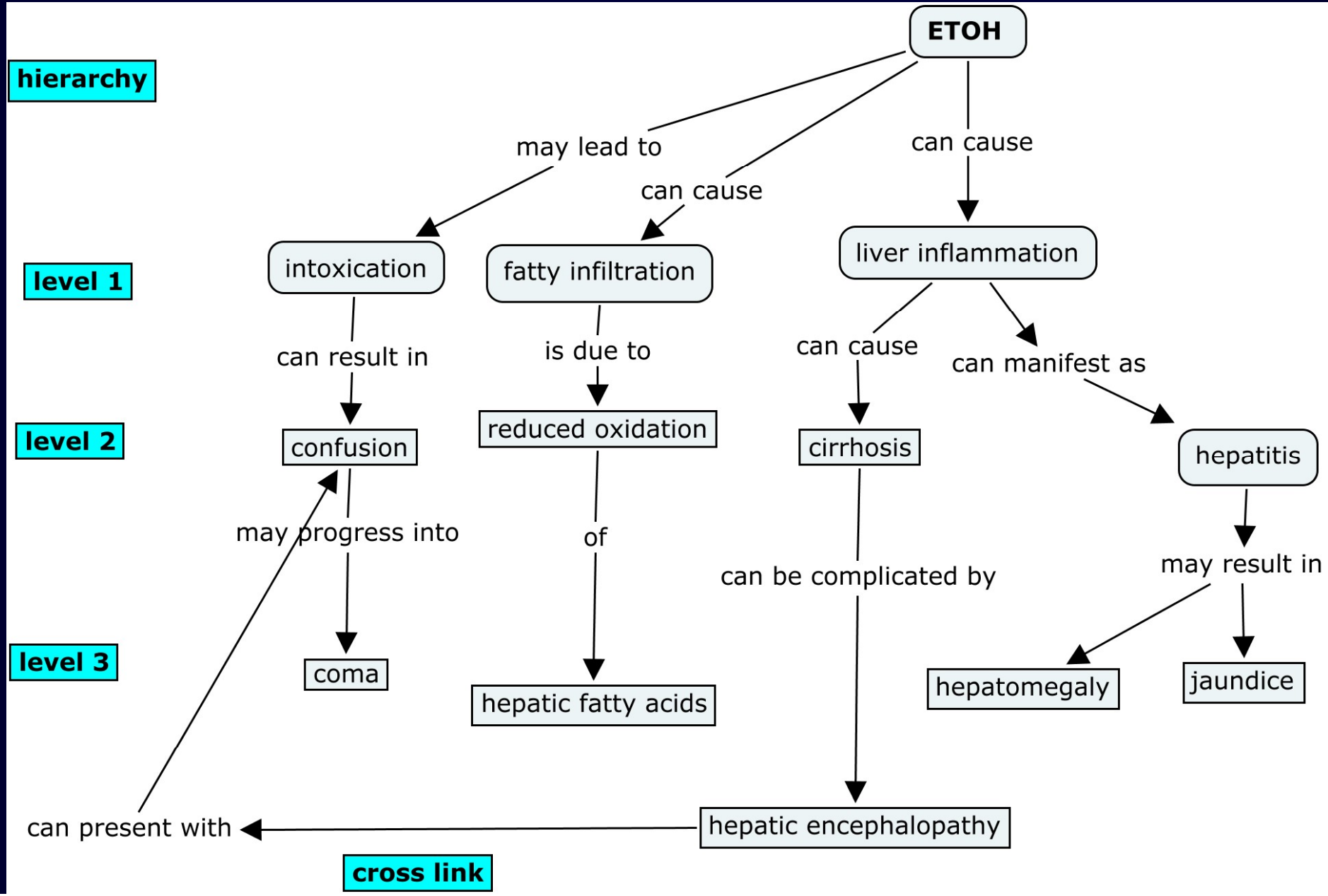
Identify most general concept and place at the top of the map

Identify more specific concepts that relate to the general concepts

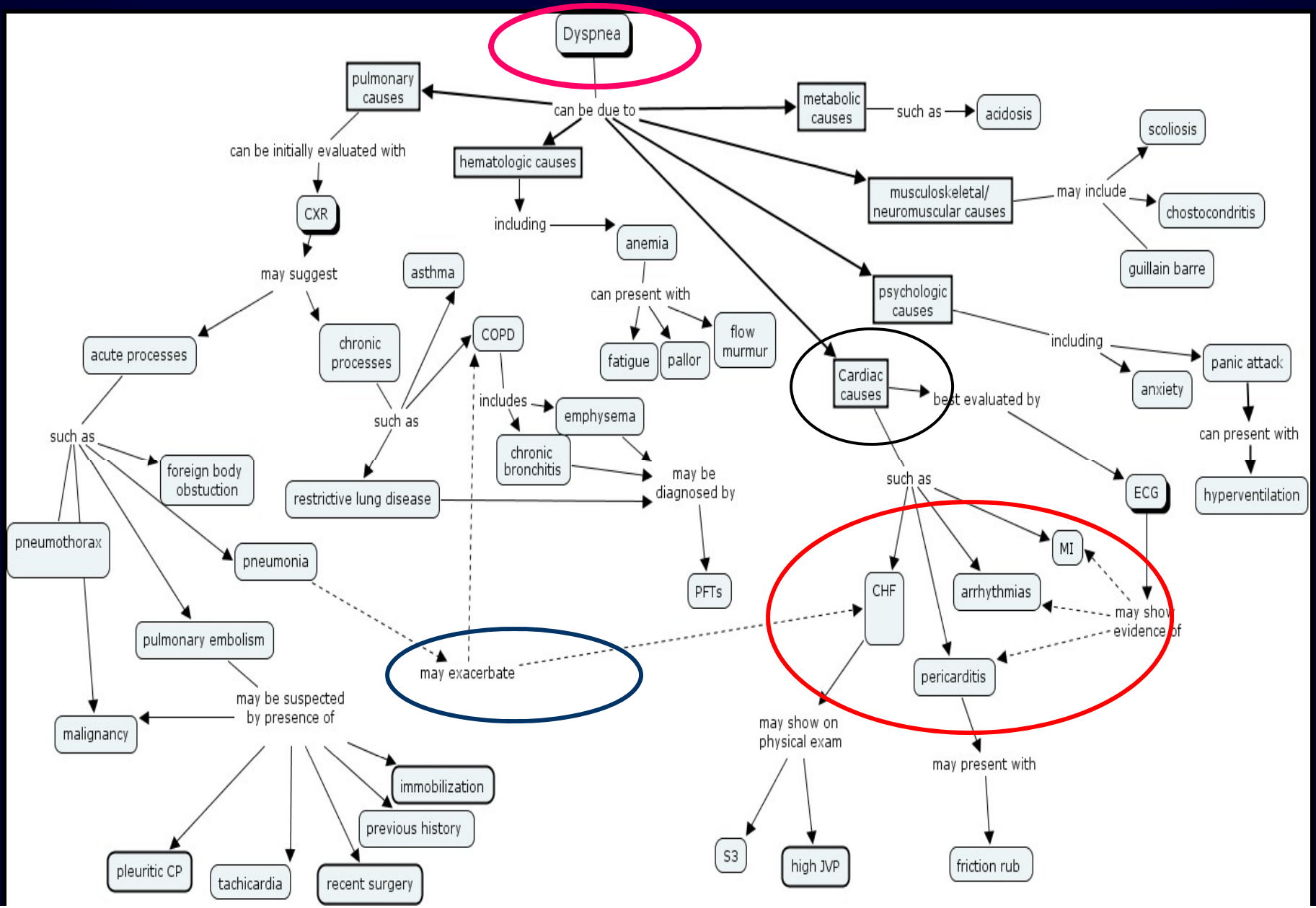
Tie the general and specific concepts together with linking words in some fashion that makes sense to you

Look for cross linkages between different domains of knowledge

Example of Concept Map



Example of Concept Map



Cmap and PBL

- the use of concept maps stimulated meaningful learning within a PBL course'. They go on to state: 'PBL and concept mapping proved to be complementary tools because the method of information gathering, hypothesis generation, and identification of learning issues allowed for the exposure of a broad range of knowledge needs that were visualized in the concept maps.'

- Rendas A, Fonseca M, Pinto P. Toward meaningful learning in undergraduate medical education using concept maps in a PBL pathophysiology course. Adv Physiol Educ 2006;30:23–9.

Cmap and feedback

- Morse and Jutras provide us with an ever-greater understanding of the role that feedback can play in teaching and learning with concept maps.
- In their study, students in a cell biology course were divided into three groups. The control group did not construct concept maps; the second group constructed maps individually, and the third group created maps individually and then discussed them in teams that provided both peer and instructor feedback.
- Results from this study indicate that ‘concept maps without feedback had no significant effect on student performance, whereas concept maps with feedback produced a measurable increase in student problem solving performance and a decrease in failure rates’

- Morse D, Jutras F. Implementing concept-based learning in a large undergraduate classroom. CBE Life Sci Educ 2008;7 (2):243–53.

- Major purpose of concept mapping is to foster the development of shared meaning between the instructor and the student. As instructors and students discuss, think about and revise concept maps, their learning and shared meaning-making processes deepen. This study demonstrates how the discussion of concept maps in a group, combined with feedback on the maps provided by the instructor, fosters students' learning and performance.

- Roberts L. Using concept maps to measure statistical understanding. Int J Math Educ Sci Technol 1999;30 (5):707–17.

Cmaps and learning

- Torre et al. performed a thematic analysis of 3rd year MS perceptions after developing 3 cmaps in a medicine clerkship
- students reported that " the concept maps allowed for creativity by developing a system of thinking that included pattern recognition, the ability to think broadly on topics, and finally, allowed for knowledge integration."

- Torre DM, Daley BJ, qualitative evaluation of medical student learning with concept maps. Med Teach 2007;29:949–55.

Cmap and group learning

- Kinchin and Hay study concept mapping in collaborative learning. They placed students in groups of three and asked them to produce a consensus concept map on the topic of pathogenic microbes.
- Findings indicated that students who were in triads of individuals with very different knowledge structures showed greater improvements in their learning than students who were in groups with more similar knowledge structures

- Kinchin I, Hay D. Using concept maps to optimize the composition of collaborative student groups: a pilot study. J Adv Nurs 2005;51 2):183–7.

Cmap and scoring

- West et al studied both a structural and a relational scoring method.
- Structural scoring is based on the map's organization of hierarchical structure, concept links and cross-links. Structural scoring assigns points for each valid component in four categories. Relational scoring is based on the quality or importance of each component, with no regard to the overall structure of the map.
- They found that structural scores increased significantly, particularly with more experienced residents, yet relational scores were not significantly different.

- West DC, Park JK, Pomeroy JR, Sandoval J. Concept mapping assessment in medical education: a comparison of two scoring systems. Med Educ 2002;36:820–6.

Cmap and assessment

- West et al found that concept mapping assessment (CMA) scores improved after course instruction; however, CMA scores did NOT correlate with final course or standardized test scores.
- 'the absence of a positive correlation suggests that CMA measures a different knowledge characteristic than do multiple-choice examinations';
- CMA has the potential to evaluate how students or residents organize and use knowledge in a way that traditional tests cannot

- West DC, Pomeroy JR, Park JK, Gerstenberger EA, Sandoval J. Critical thinking in graduate medical education: a role for concept mapping assessment? JAMA 2000;284 (9):1105–10.

Cmap and assessment

- McGaghie et al. conducted a quantitative study that used Pathfinder scaling to evaluate concept maps for internal consistency, student–instructor similarity and correlational relationships to final examination results. Although descriptive analysis did not show a correlation between student–instructor concept map similarity scores and scores on examinations, student scores were internally consistent and the similarity of student maps with instructor maps increased significantly following instruction.

- McGaghie WC, McCrimmon DR, Mitchell G, Thompson JA. Concept mapping in pulmonary physiology using Pathfinder scaling. Adv Health Sci Educ Theory Pract 2004;9:225–40.

Cmap and assessment

- McGaghie et al. also report on three additional studies that attempted to compare concept maps developed by faculty experts with maps prepared by medical students. Findings indicate that after a 3-week unit in pulmonary physiology, student and expert maps were more similar. However, authors also report a wide variety in the maps of experts.

- McGaghie WC, McCrimmon DR, Mitchell G, Thompson JA, Ravitch MM. Quantitative concept mapping in pulmonary physiology: comparison of student and faculty knowledge structures. Adv Physiol Educ 2000;23 (1):72–81.

Cmap and curriculum

- Weiss and Levison, by contrast, describe using concept maps as a blueprint for the development of curricular goals and objectives. They also indicate that the maps can serve to assist with the integration of curricular themes across and among departments and disciplines, and describe how the maps assisted in the development of a women's health medical education collaboration.

- Weiss LB, Levison SP. Tools for integrating women's health into medical education: clinical cases and concept mapping. Acad Med 2000;75 (11):1081–6.

Cmap as knowledge models

- Willemsen et al.observe that, within clinical genomics research, ‘one of the main challenges is the acquisition and integration of data, information, and expert knowledge for specific biomedical domains and diseases’. They created 155 concept maps linked together in a knowledge model that allows for the visualization of vast amounts of information.43 These ontologies and knowledge models have the potential to provide highly integrated and organized knowledge frameworks that can be applied to medical student learning and clinical performance.

- Willemsen AM, Jansen GA, Komen JC, van Hooff S,Waterham HR, Brites PM, Wanders RJ, vanKampen AHC. organization and integration of biomedical knowledge with concept maps for key peroxisomal pathways. Bioinformatics 2008;24 (16):21–7.

Uses of concept mapping

- To evaluate a course/a rotation
- To provide feedback and identify knowledge deficits or gaps in understanding
- To create knowledge models or curricula
- To assess reflection and critical thinking
- To assess or help understanding
- To help develop a research idea or project
- To learn in collaboration with others

Implications

- there is a growing body of evidence on the effectiveness of mapping as:
  - a method to promote meaningful learning,
  - a resource for learning,
  - a methodology for providing student feedback, a
  - an assessment strategy in medical education.

- In addition, new work by Gonza´lez et al.21 provides interesting information on the use of concept maps in medical education. These authors divided their students into two groups: a control group, which attended a traditional course in physiology, and an intervention group, which constructed concept maps ‘related to cardiovascular physiology and used them to solve problems related to this subject’.21 Both groups of students were tested using two types of examination: a problem-solving examination and a multiple-choice examination. Findings indicate that the group using concept maps performed significantly better on the problem-solving examination. Their performance on the multiple-choice examination was similar to that of the traditional group. These findings by Gonza´lez et al.21 seem to uphold those of Roberts,38 who found no significant change in concept map scores over time but did find significant correlations between map scores and practical assignment scores.

- Gonza´lez HL, Palencia AP, Uman˜a LA, Galindo L,Villafrade MLA. Mediated learning experience and concept maps: a pedagogical tool for achieving meaningful learning in medical physiology students. Adv Physiol Educ 2008;32 (4):312–6.

- Roberts L. Using concept maps to measure statistical nderstanding. Int J Math Educ Sci Technol 1999;30 (5):707–17.

Scoring method

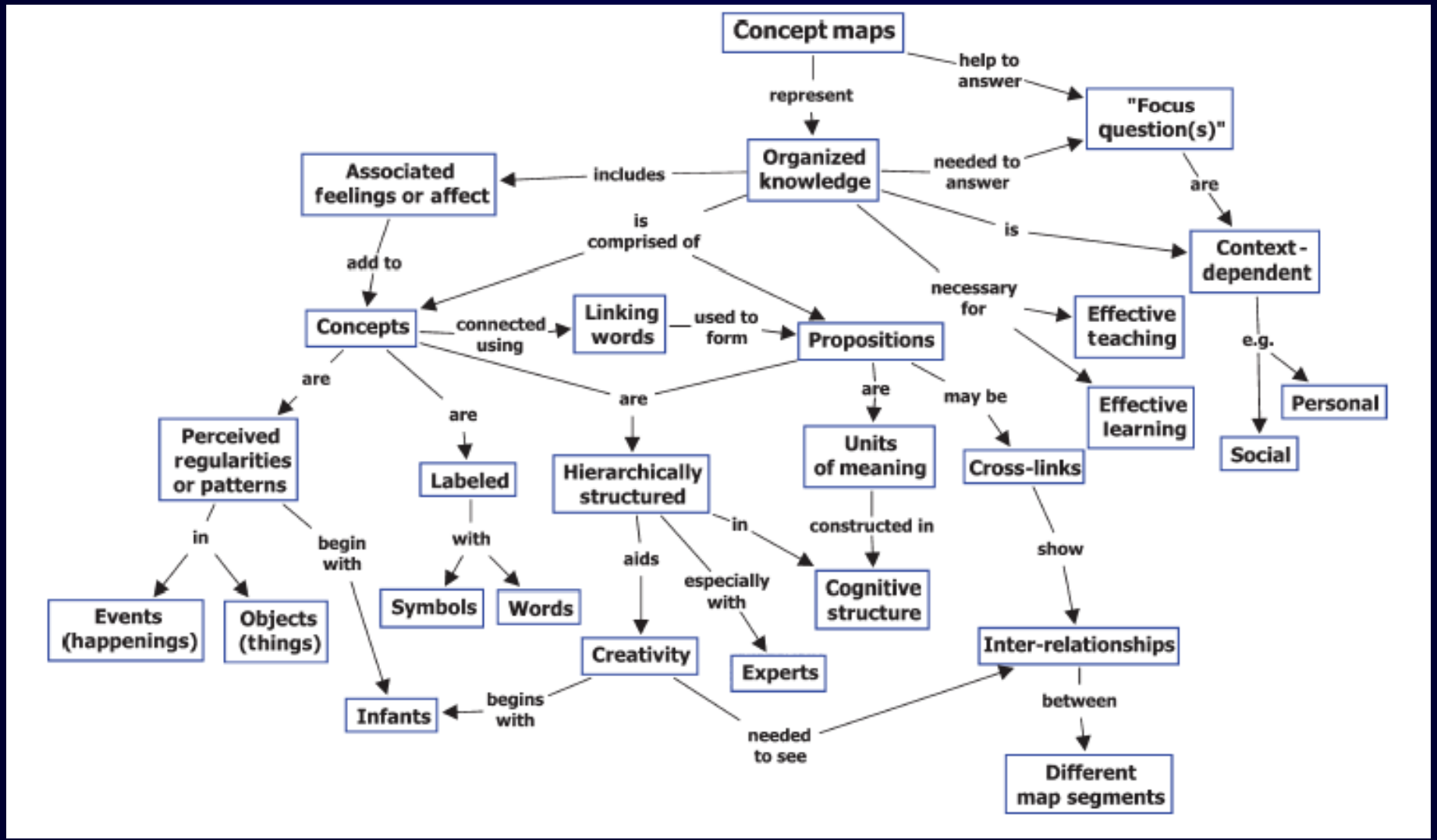
- Hierarchy
  - Most general to most specific
- Concept links
  - Concept link to another concept (valid and significant)
- Cross-links
  - Relating different domains of knowledge
- Examples
  - Usually in the most subordinate position

Educational applications

- To roadmap a learning route
  - facilitate acquisition and recall of ideas and meanings about a topic
- To extract meaning from a textbook or an article
- To extract meaning from a clinical case
- To better understand a journal article
- To plan a paper or a presentation

Future directions

- Assess learning and understanding of about specific medical topics
- Establish relationship with other measurements of knowledge and or skills (NBME exam, OSCEs,etc..)
- Collect longitudinal data on critical thinking medical school and/or residency program
- Assess reliability of scoring system


Concept maps
help to answer
represent
"Focus question(s)"
Organized knowledge
Associated feelings or affect
includes
needed to answer
are
is
is comprised of
Context-dependent
add to
necessary for
Concepts
connected using
Linking words
used to form
Propositions
Effective teaching
e.g.
Personal
Effective learning
Social
are
are
are
may be
are
Perceived regularities or patterns
Labeled
Hierarchically structured
Units of meaning
Cross-links
in
with
in
constructed in
show
begin with
aids
especially with
Events (happenings)
Objects (things)
Symbols
Words
Cognitive structure
Creativity
Experts
Inter-relationships
begins with
Infants
between
needed to see
Different map segments