Active Learning – Concept Maps

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What is a Concept Map?

A concept map is a visualization of knowledge that is organized by the relationships between the topics. At its core, it is made of concepts that are connected together by lines (or arrows) that are labelled with the relationship between the concepts. The concepts are usually found in circles or boxes. Concept maps are a cross disicplinary active learning technique that help students manage concepts into sub-concepts, synthesize information, see a larger picture and develop higher-order thinking skills and strategies (Lee et al, 2013). Concept maps can summarize a part of a book, connect historical events, describe how a business is run, develop a personal care plan or patient treatment, describe how the body works, or the interconnectedness of a wetland's ecology. A concept map may be used as a pre-class assignment, small group activity, whole class activity or a way to summarize the information at the end of a class or project. Instead of reading explanations from students, concepts maps provide a way to quickly look through students thinking process and understanding of concepts.
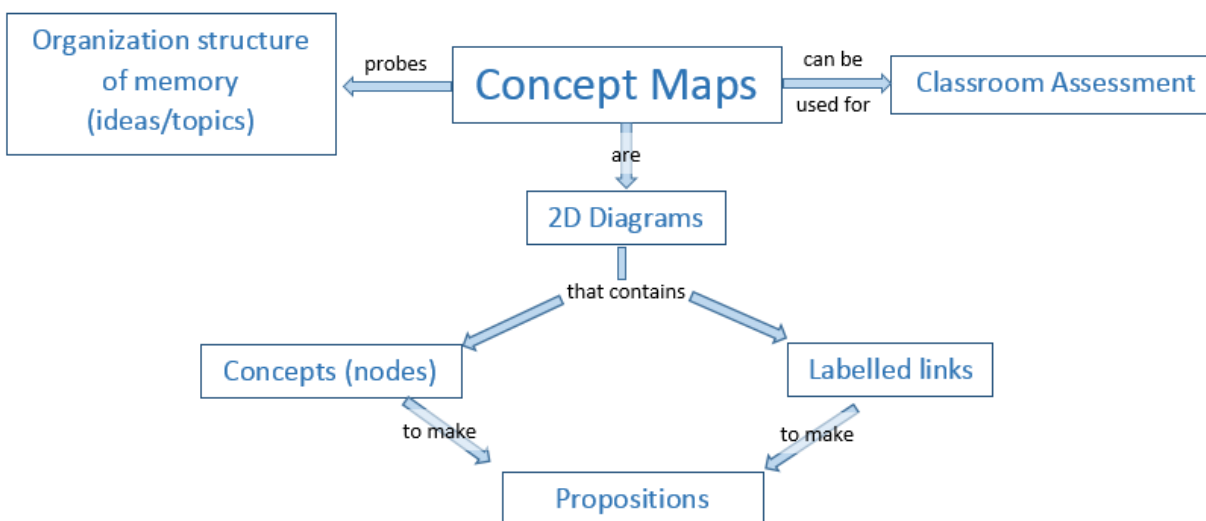
Introduction

Novak developed concepts maps as a way to prompt meaningful learning (Novak and Gowen, 1984). They were built on Ausubel's cognitive psychology, learning happens with the assimiluation of new concepts and proposition into exisiting concepts (Novak & Musonda, 1991).

Students are forced not only to think about the range of concepts connected to the main topic but also identify what connects those ideas. Concept maps improve students critical think and learning outcomes across disciplines (Harris & Zha, 2014; Sadler et al, 2015; more references?). Some researchers and instructors are more strict than others, separating concept maps from mind mapping,

conceptual diagrams and visual metaphores (Eppler, 2006). At the most simple definition, concept maps do not use graphics and are top-down heirarchical (when appropriate) while mind maps and visual metaphors use graphics and symbols. Conceptual diagrams are not heirarchical but use size of boxes to depict more central topics and can be read top-down or left-right. This TTIF focuses on the most simple form of a concept map, acknowledging the other types of visualization methods can also be beneficial to student learning.

Concept maps can be used in a variety of ways; whether for studying, self-assessment, as an activity or as a way of visualizing student work for grading. In the later example, instructors input students writing into a software program that automatically generats a concept map (Xiong & Wu, 2017). The students then views the concept map to determine if their writing was clear. More typical variations on implementation can be found in the next section.

Implementing concepts maps are as simple (and complex) as

1) determine the topic, domain, question or problem that the concept map will focus on
2) brainstorm key concepts related to this prompt
3) determine and label the relationships between key concepts and the prompt and across key concepts (start to draw map)
4) finalize the layout of the concept map (if there are hierarchical topics, the highest level should be at the top and examples and specific details at the bottom)

Implementation Basics

1. Be sure students understand the expectations (purpose, variables, how to use linking phrases to show relationship between variables, direction of arrows, number of connections)
   a. Share an example of what the map might look like (something they are familiar with) and discuss what else might be added to them
   b. Use concept maps throughout the semester; it takes time for students to be introduced and get used to the topic
2. Have students share
   a. Students can explain and critique each other's concept map
   b. Students write short explanations regarding their concept map (possibly including what changes they have made to their concept map and why)
3. Be sure to have clear assessment criteria and grading developed so that grading is not as time-consuming or subjective.
   a. Students could get points for completion, be allowed to use their concept map on an exam or there can be peer critiques of the map with no grading at all
   b. Quick grading options
      i. Count nodes/correct connections and students could earn a total amount of points: 1 point for each concept, 2 points for each appropriate link
      ii. Checklist: do they have certain concepts, links are correct and logical, text is clear and easy to read, information is clear….
      iii. Rubric: Criteria could include organization, links, ideas, communication, teamwork, etc. (review the TTIF rubrics for more general information)

Implementation Variations

Students are provided part of the map
- Give students all of the words they are expected to put in their map and decide on connections
- Give students a partially filled out map/template, leaving some connections unlabeled, empty boxes and have them fill out the rest of the map
- Give students a list of words they should put in their concept map

Collaborative/collective concept maps
- Have students critique each other's maps: what is missing, rethinking x…
- Start students off with 1-2 ideas around the central topic. Students (not talking with each other) come up and add their own ideas to the board. You can stop, clarify, ask questions and dig deeper as they write connected topics on the board.

Concept map across classes
- New topics are added to their concept map and/or revise their previous one at the end of each class; give students 2-5 minutes each day.
- At the beginning of class, students add what they learned from their pre-class work to their concept map.
- Have students write explanatory essays about their concept map

Frequently Asked Questions

a) *Students are not critiquing each other's maps in robust ways, what should I do?* Provide students a bit more direction when critiquing each other's maps and possibly guidelines to ensure critiquing is done respectfully. Encourage peers to identify what important elements might be unclear or absent from their map or compare/contrast each other's maps. If suggestions are made, students should have to explain and provide justification for a suggested change; helping to highlight or clarify concepts.

b) *Should the map be centered on one topic?* Initially limiting students to one main topic will help them brainstorm connections. If you are using the concept map across class sessions, there will inevitably be more topics – a large main topic may need to be added to incorporate both key concepts/topics across classes.

c) *Are there quick methods to give students credit for something more than just completion*? Yes – there are some checklists and rubrics for assessing ([link to checklist](#), [link to rubric](#), [link to other rubric](#)).

d) *It would be faster for me to just give them the completed concept map for them to study from, when do you recommend I give it to them?* Those who do, do the learning – the strength of the concept map is the student putting topics together and recognizing relationships between topics. If students have developed their own concept map, it would be fine to give them a copy of one you made or a previous student as a way of them self-grading their concept map for studying purposes; note that the more times you give out "good" concept maps, the less likely students will start from scratch in future classes.

Other Resources

- Example with peer dialogue and grading examples:
  https://scholarworks.iu.edu/journals/index.php/thst/article/view/23006/30060
- Concept Maps: Basics guide to concept maps: https://msu.edu/~luckie/ctools/
- Taken from full Novak & Canas version: http://cmap.ihmc.us/docs/theory-of-concept-maps
- Concept Mapping in The Classroom: Kath Schrock's Guide to Everything. *More than 2 dozen links regarding concept background, how tos, samples, assessment options and a tools you and your students can use to make concept maps.* http://www.schrockguide.net/concept-mapping.html
- Three editable templates for online design of concept maps:
  https://creately.com/blog/diagrams/ultimate-concept-map-tutorial/
- Tutorial about concept maps with self-quiz (students could take a picture of their screen showing time/date and score from the tutorial) http://tutorials.istudy.psu.edu/conceptmaps/index.html
- 6 minute video for faculty on use of concept maps in the classroom:
  https://www.youtube.com/watch?v=Gm1owf0uGFM&feature=youtu.be
- Basic rubric for concept map: http://ar.cetl.hku.hk/am_cm.htm
- Groups of tools for making maps with explanations: https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/educational-technologies/all/concept-mapping-tools

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