

Using Knowledge Space Theory to Analyze Concept Maps

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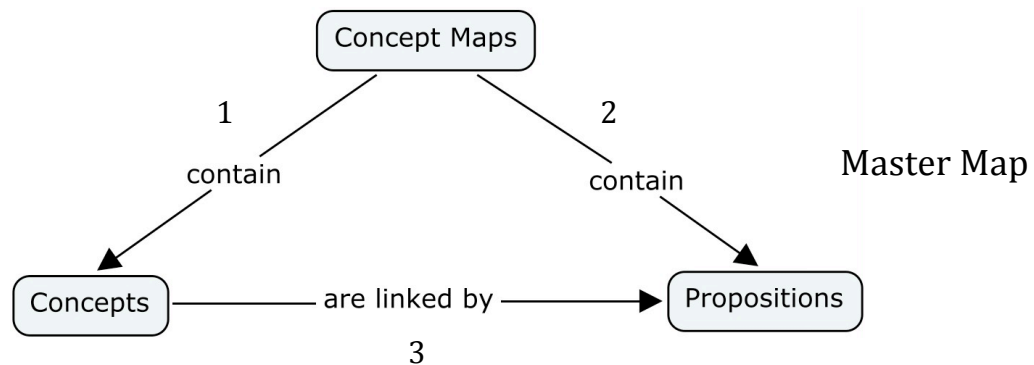
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For analysis of a set of concept maps for which there is:

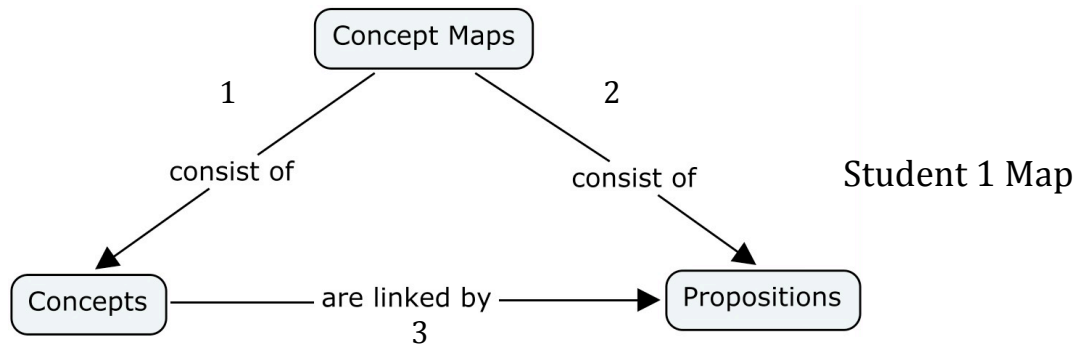
- 1) A master map that was constructed by the course instructor and
- 2) An assigned list of concepts used to construct the maps.

1. Assign number codes to the propositions on the instructor's master concept map.

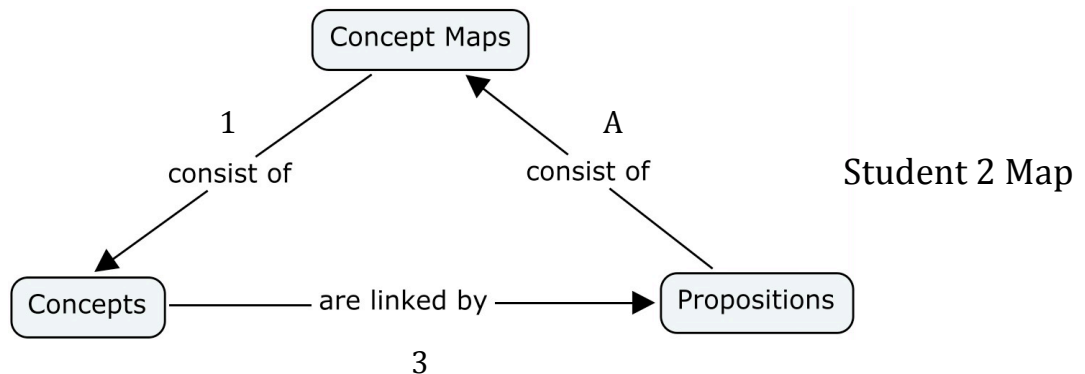


2. Analyze each student concept map by:

- a. Assigning the number codes to propositions that are qualitatively similar to the master map's propositions.

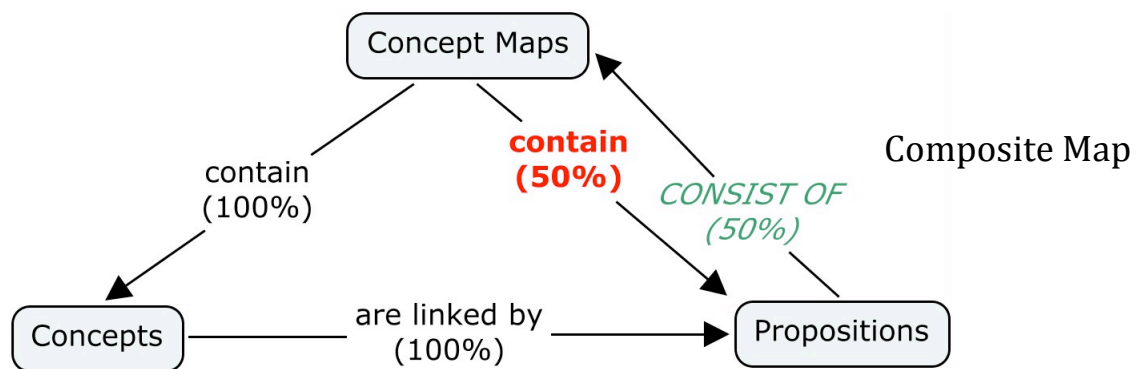


- b. Assigning letter codes to student generated propositions that are not on the master map.



IHMC CmapTools (<http://cmap.ihmc.us/conceptmap.html>) was used to construct the concept maps depicted in this presentation.

3. Make separate lists for instructor generated and student generated propositions and their respective codes. Tally the frequency of all qualitatively similar propositions on each list.
4. Calculate the percentage of students' maps that were assigned each number and letter code.
5. Set the threshold for highlighting instructor generated propositions that appear on less than X percent of the student' concept maps. Cathcart et al., 2010 set this threshold at 50%.
6. Set the threshold for highlighting student generated propositions that appear on more than X percent of students' concept maps. Cathcart et al., 2010 set this threshold at 25%.
7. Construct a composite map to graphically depict the findings of the analysis.
 - Instructor generated propositions that appear on equal to or more than X percent of the students' concept maps (threshold set in step 5) should be drawn in black text.
 - Instructor generated propositions that appear on less than X percent of the students' concept maps (threshold set in step 5) should be drawn in **red** or **bold** text.
 - Correct student generated propositions that appear on more than X percent of the students' concept maps (threshold set in step 6) should be drawn in **BLUE** or CAPITAL text (not shown below).
 - Incorrect student generated propositions that appear on more than X percent of the students' concept maps (threshold set in step 6) should be drawn in **GREEN** or **ITALICS CAPITAL** text.



References:

- Cathcart, L.A., Stieff, M., Marbach-Ad, G., Smith, A.C., Frauwirth, K.A. (2010). Using Knowledge Space Theory to Analyze Concept Maps. In K. Gomez, L. Lyons, & J. Radinsky (Eds.), *Learning in the Disciplines: Proceedings of the 9th International Conference of the Learning Sciences: Vol. 1. Full Papers* (pp.952-959). Chicago, IL.: International Society of the Learning Sciences.
- Falmagne, J., & Doignon, J. (1988). A Markovian procedure for assessing the state of a system. *Journal of Mathematical Psychology*, 32, 232-258.
- Kinchin, I. M., Hay, D. B., & Adams, A. (2000). How a qualitative approach to concept map analysis can be used to aid learning by illustrating patterns of conceptual development. *Educational Research*, 42(1), 43-57.
- McClure, J., Sonak, B., & Suen, H. (1999). Concept map assessment of classroom learning: reliability, validity, and logistical practicality. *Journal of Research in Science Teaching*, 36(4), 475-492.
- Novak, J.D., & Gowin, D.B (1984). *Learning how to learn*. New York: Cambridge University Press.
- Taagepera, M., & Noori, S. (2000). Mapping students' thinking patterns in learning organic chemistry by the use of knowledge space theory. *Journal of Chemical Education*, 77(9), 1224-1229.
- Ruiz-Primo, M. A., & Shavelson, R. J. (1996). Problems and issues in the use of concept maps in science assessment. *Journal of Research in Science Teaching*, 33(6), 569-600.

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