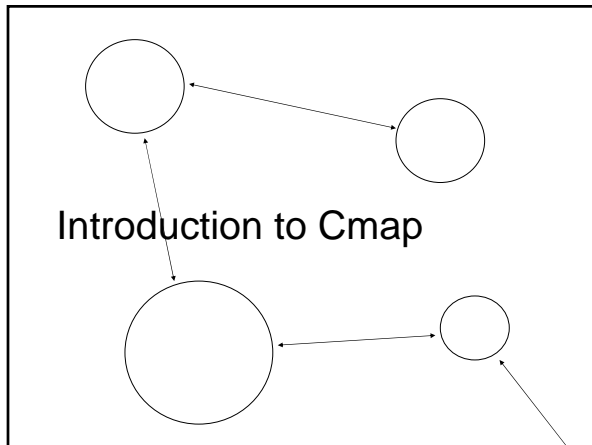
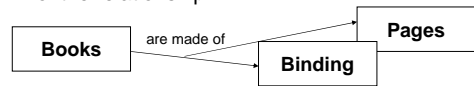


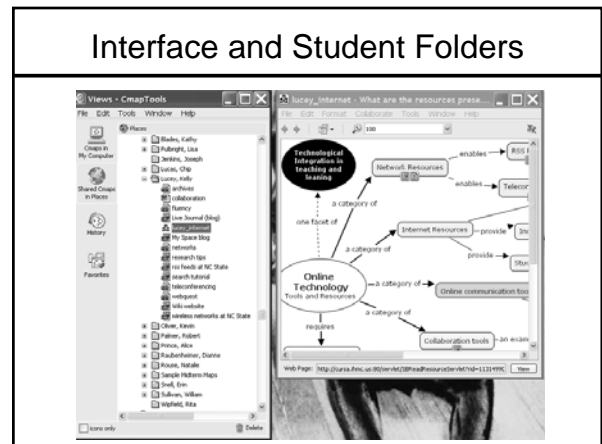
- ### Outline
- Introduction to Cmap
  - Strategies for Employing Concept Maps with Implications for Thinking
  - School Projects and Findings



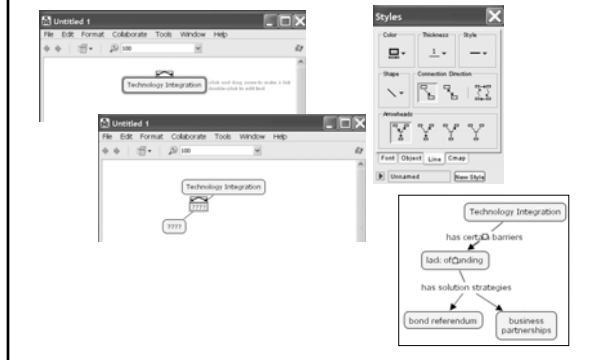
- ### Concept Mapping Defined
- concept mapping is a technique for organizing and representing information
  - a true concept map must include:
    - core concepts - usually enclosed in circles or boxes
    - relationships illustrated by lines and arrows connecting concepts AND by propositions or statements on those lines that explain the nature of the relationship



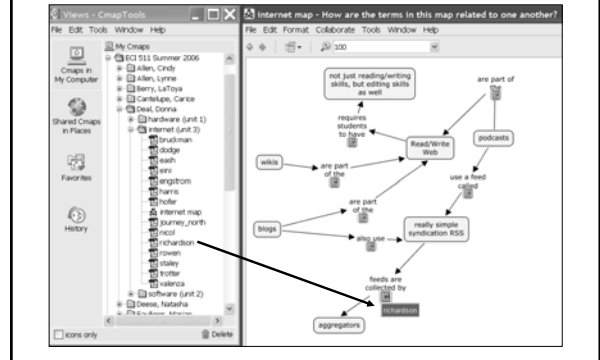
- ### Cmap
- freeware tool developed by the Institute for Human and Machine Cognition (IHMC), affiliated with UWF, UCF, FAU
  - James Novak, collaborator
  - download desktop tools and server software from <http://cmap.ihmc.us/>
  - public servers available for schools that don't have a dedicated server



## Creating Concepts and Propositions

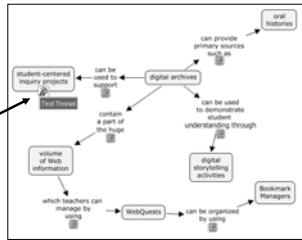


## Justifying Concepts/Relationships w/ Resources



## Collaborative Options

- synchronously edit maps with the support of chat
- asynchronously edit maps with the support of discussion boards attached to concepts or propositions

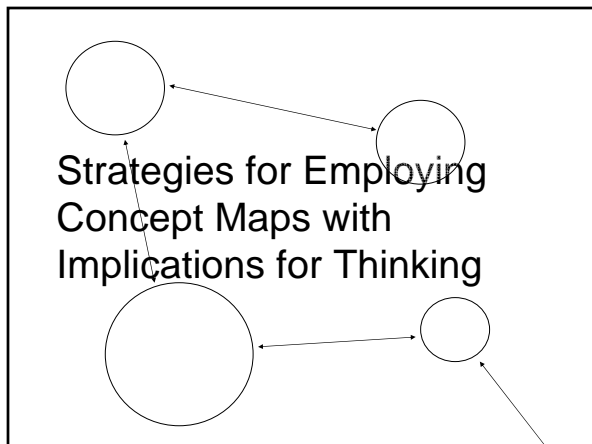


## Collaborative Options

- asynchronously edit maps with the support of "knowledge soups"
- share claims with a small or large group

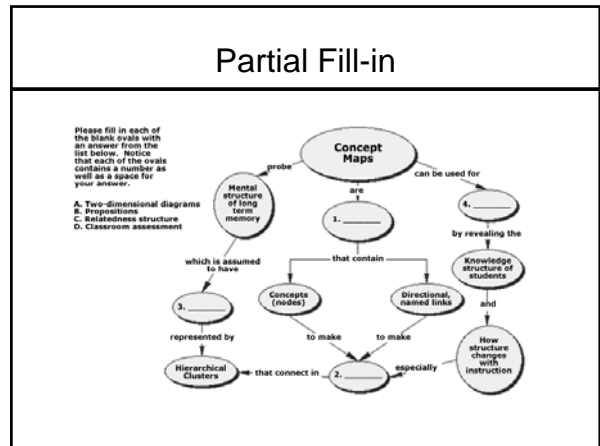
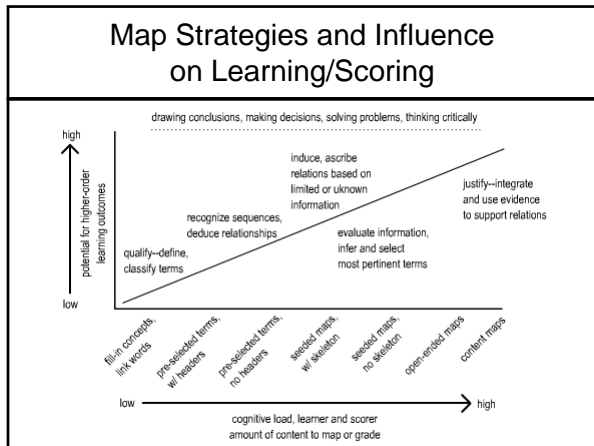


## Strategies for Employing Concept Maps with Implications for Thinking



## Thinking Skills Model

- Barbara Presseisen, "Thinking Skills: Meanings and Models Revisited"
- Arthur Costa's (Ed.) "Developing Minds: A Resource Book for Teaching Thinking"
- basic thinking skills: qualifying, classifying, finding relationships, transforming, and drawing conclusions
- complex thinking processes: problem solving, decision making, critical thinking, creative thinking

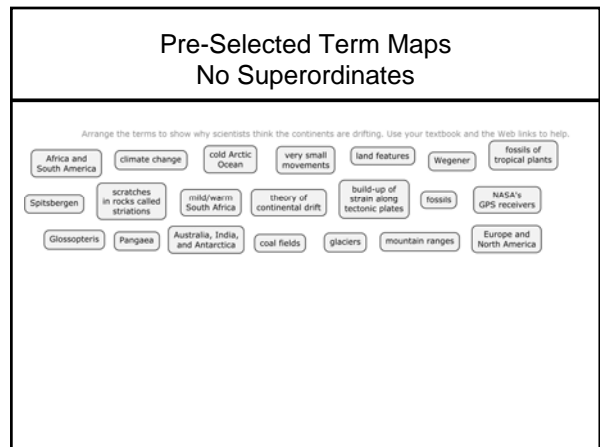
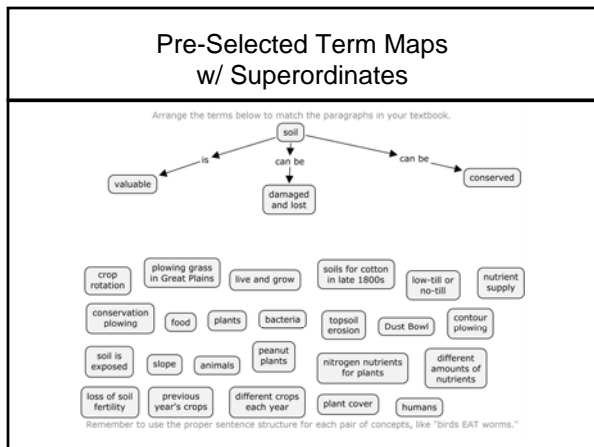
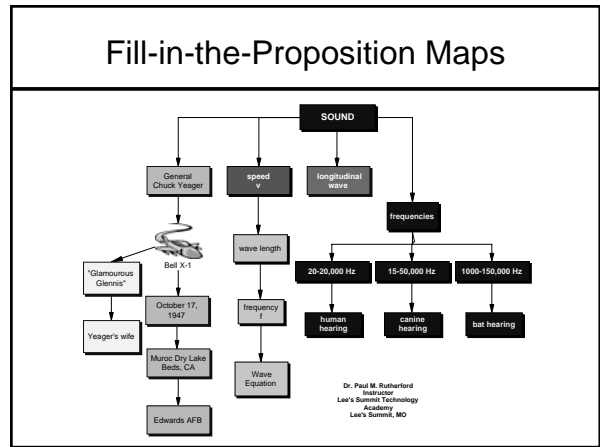


### Complete Fill-in

- fill-in blanks in pre-structured map from a list of concepts
- helps students to consolidate understanding of concepts and relations among them

Concept list:

- Albedo of earth's surface
- Angle of the sun above the horizon
- Curvature of the earth
- Degree of "spreading out" at earth's surface
- Distance between earth and sun
- Distance traveled through earth's atmosphere
- Ellipticity of the earth's orbit
- Fraction of radiation absorbed/reflected in earth's atmosphere
- Insolation at top of atmosphere, during the day
- Insolation at earth's surface
- Latitude
- Revolutions of earth around sun
- Rotations of the earth
- Seasons
- Tilt of earth's axis of rotation, and its constant orientation (relative to distant stars)
- Time of day
- Time of year



## Expert Skeleton Maps

- a partial map is structured with seeded terms
- students must build on starter map and integrate additional terms



## Seeded Term Maps

- also called "micro-mapping"
- provide students with an unstructured list of "starter" or "seed" terms (5-6)
- students must use these terms in their map AND use another 9-10 terms from their own knowledge of the topic



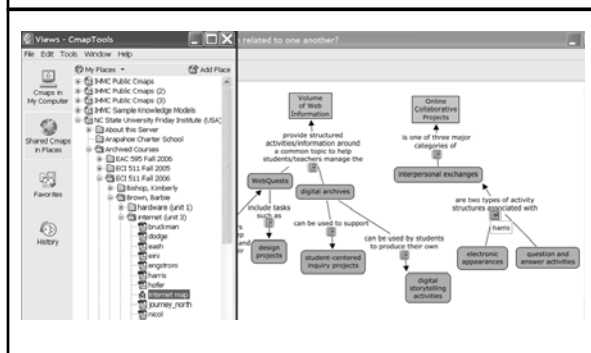
## Open-Ended Maps

- once students are familiar with concept mapping processes, they can also complete open-ended maps
  - after reading a section of text
  - at the end of a section of course work
  - at the end of the course
- helps with identifying and tying together core concepts
- "Create a concept map to explain why scientists think the continents are drifting."

## Content Maps

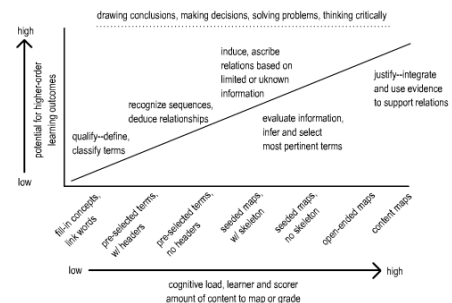
- increasingly, mapping programs allow people to attach resources to concepts (e.g., notes, links, images, files)
- selecting and adding content resources to concepts or relationships adds yet another layer of detail to maps
- can be used by students to justify their maps on the basis of real evidence (i.e., these two articles discussed the relationship of X and Y)

## Content Maps



## Map Strategies and Influence on Learning/Scoring

possibility of scaffolding more complex tasks with collaborative "talk" about map





## Thinking Skills Exhibited

- success classifying terms
- more difficulty identifying specific pairings/sets
- most difficulty writing propositions

Site	Map/Reading	# of Maps Scored	# of Super. Concepts	Mean # Concepts Classified Correctly	Mean # Concept Sets Identified	Mean # Correct Propositions
1	1-Energy	21	3	13.8/15 (92%)	6.4/9 (71%)	6.5/9 (72%)
	2-Pop.	20	4	13.7/17 (81%)	2.2/6 (37%)	4.9/12 (41%)
	3-Pollution	18	6	13/16 (81%)	2.5/6 (42%)	6.6/13 (51%)
2	Cont. Drift	46	4*	11.2/17 (66%)	4.2/6 (70%)	8/15 (53%)
	Soil Csv.	74	4	18.9/24 (79%)	5/10 (50%)	9.7/22 (44%)

## Success with Special Populations

- at site two, 2 of 3 special education inclusion students beat the class average in terms of concept classifications and came close to the class average in terms of correctly grouped concept sets and written propositions
- at site three, 8 English as a Second Language (ESL) students and four Exceptional Children (EC) with behavioral or social disabilities outperformed the class average on all three variables--correctly classified concepts, grouped sets, and written propositions
- average percentile score on the state's end of 5th grade reading comprehension test was only 18 for the eight ESL students and 15.5 for the four EC students, compared to 40.5 for the entire population (n=61)

## Success Across Reading Levels

- 1-way ANOVA indicates almost no significant differences across 4 state reading groups (1-deficient mastery, 2-inconsistent mastery, 3-mastery, 4-superior mastery) in terms of concepts classified, concept sets identified, and correctly written propositions
- only 1 of 3 concept maps completed at site one showed significant differences in the performance of students in different reading groups, and it was associated with the longest reading, and no scaffolds (i.e., circled terms)
- students of all reading levels can experience at least moderate success with concept mapping when presented with relatively concise readings, embedded scaffolds (i.e., circled terms), and a pre-selected term task structure

## Concept Learning

- t-tests comparing each pre-test to post-test revealed significant differences

Site	Map	n	Pre-Test	Post-Test	2-Tailed P
1	1-Energy	21	3.5/7	5.9/7	< .0001
	2-Population	22	3.3/7	4.4/7	.0194
	3-Pollution	17	2.4/7	5.0/7	< .0001
2	Cont. Drift	44	3.4/8	4.6/8	< .0001
3	Soil Conserv.	58	2.3/10	4.4/10	< .0001

## Concept Learning

- control groups employed at sites 1 and 3
- 1-way ANOVA indicates no significant differences between map and control groups on pre-test
- however, significant differences noted on post-test for the 3rd map completed at site 1 (F 4.75, p = .01), and the only map completed at site 3 (F 4.3, p = .01)

## Motivation

- a majority of students enjoyed Cmapping with 19% and 46% (n=124) indicating they "loved it" or "liked it" respectively
- a minority group of students at 2% and 6% "disliked" or "hated it"
- when asked to choose between reading with Cmap or just reading, 43% (n=124) of students indicated they would "definitely" use Cmap, and 34% indicated they would "probably" use Cmap
- only 6% and 8% of students indicated they would "probably" and "definitely" just read without Cmap

### Lessons Learned

- providing superordinate headers with pre-selected terms may better support classification thinking than recognizing sequences and deducing relationships
- all 3 teachers were interested in students selecting their own terms from readings, but this is a higher level skill not recommended for beginners, and makes scoring maps more difficult and subjective

### Lessons Learned

- 2 of 3 teachers believed students could move up to higher-level mapping tasks with practice
- 78% of students (n=121) interested in collaborating with at least one other student, so good opportunity to leverage discussion and negotiation of map
- shortcoming of maps in schools--time available to receive feedback and revise, so collaboration ensures students at least receive feedback on their thinking from peer discussion

### Resources

- download slides online at:  
<http://kevoliver.com/pdf/ncaect.pdf>
- Cmap, <http://cmap.ihmc.us/>
- sign up for a school/teacher account to save and store student maps on our server; pick up a "getting started" handout