good metaphor. Students shared that some metaphors seem obvious and almost literal, like a road to symbolize a journey or a tree to stand for growth, while other metaphors were more complex, like a water droplet representing the idea of feeling simultaneous separation and integration since a water droplet has its own uniqueness but at the same time gets lost once it is combined with other droplets.

Based on these discussions about the degree of complexity and sophistication of metaphors, Nathan decided to push students' metaphoric thinking. Working with a subsequent text, Nathan drew a selection of random and varied objects and asked students to relate them to the text as possible images: "How might these drawings fit what we have just read as possible CSI images?" As students discussed and justified how the objects Nathan had drawn might connect to the text, they were developing their ability to create rich metaphors by connecting features of the text to features of the images.

With this initial experience using the CSI routine and thinking deeply about metaphors behind them, Nathan developed a scaling system for evaluating the quality of the metaphors students created. This "metaphoric level" was a continuum on a scale of 1 = low to 10 = high. Students used this scale to self- and peer assess as they continued to use the CSI routine throughout the year. During these sessions, Nathan continued to modify the routine to meet his needs and push students' thinking. Sometimes students were put in groups to do the CSI routine, thus requiring them to discuss and evaluate their choices of color, symbols, and images with their peers. To further extend students, Nathan sometimes asked for a quote from the text to be given to accompany students' choices. In this way, students were forced to justify the big ideas and themes they identified.

GENERATE-SORT-CONNECT-ELABORATE: CONCEPT MAPS

Select a topic, concept, or issue for which you want to map your understanding.

- *Generate* a list of ideas and initial thoughts that come to mind when you think about this topic or issue.

- *Sort* your ideas according to how central or tangential they are. Place central ideas near the center and more tangential ideas toward the outside of the page.

- *Connect* your ideas by drawing connecting lines between the ideas that have something in common. Explain and write on the line in a short sentence how the ideas are connected.

- *Elaborate* on any of the ideas or thoughts you have written so far by adding new ideas that expand, extend, or add to your initial ideas.

Over the years we have collectively looked at thousands of concept maps from students around the world. Regardless of the topic, one thing that we noticed was that, by and large, students don't make very good concept maps. This set us pondering over what kinds of thinking one needs to do in order to create a concept map that would both help one to organize one's thinking and ideas as well as to reveal how one understands a particular concept. The Generate-Sort-Connect-Elaborate (GSCE) routine was the result.

Purpose

Concept maps help uncover a learner's mental models of a topic in a nonlinear way. Concept maps help us to activate our knowledge of a topic and then connect those ideas in a meaningful way. Learners often find that making a concept map helps them to organize their thinking and illuminate how ideas relate to one another. This can help to solidify one's thinking and understanding as well as to reveal that thinking to others. Of course, educators and researchers have long used concept maps for this purpose. However, for a concept map to be truly revealing of the mental model or conceptual understanding a person holds, it is helpful to structure the process of creating a concept map, not to constrain the thinking but to actively foster

more and better thinking. This routine highlights the mental moves needed to create a rich and revealing concept map that makes full use of their graphical nature.

Selecting Appropriate Content

The topics or concepts selected for this routine are often of large scope: democracy, habitats, effective presentations, geometry, and so on. These topics have many parts and components to them and thus invite many and varied responses. When a big idea or goal is posed, students have an opportunity to generate a diverse list of ideas. The ensuring debate to determine the centrality of the ideas allows students to reveal the depth and breadth of their understanding. Concepts or ideas, such as freedom, power, and electricity, and processes, such as designing a science experiment, creating an animated film, or preparing for a debate, all lend themselves to this routine. The routine can be situated at the beginning of a unit to reveal what learners already know about a topic and spark discussion, or it can be used later in the unit to assess how students are making sense of ideas. Often students find that creating a concept map at the end of a unit is a good way to review what they have learned in preparation for a test or in planning to write a paper.

Steps

1. *Set up.* Check whether students know what a concept map is, and if not, explain that this is a way of showing one's thinking about a topic. If learners are already familiar with concept maps, the routine can be introduced with a brief introduction explaining that they will be creating concept maps in a structured way.

2. *Generate.* Ask students to generate a list of words, ideas, or aspects associated with the topic. Depending on the topic, this might mean you ask students to "make a list of key aspects or components of this topic" or "make a list of the various ingredients, processes, or needs associated with this goal/task." This step is designed to produce an initial list of ideas. Since it can be added to at any time, it is only important that students have a list of at least five or six items to use before beginning the next step.

3. *Sort.* Invite learners to sort their ideas according to how central or tangential they are, placing central ideas near the center and more peripheral ideas toward the outside. If desired, at this stage students can pair or form groups to do this sorting. This often results in rich debating of priorities.

4. *Connect.* Ask learners to connect their ideas by drawing lines between ideas that share a connection and to briefly explain this connection by writing it out on the line. For example, one idea might lead to another or two ideas might work in tandem.

5. *Elaborate.* Ask students to pick a few central ideas and elaborate upon them, creating subcategories that break the ideas into smaller parts.

6. *Share the thinking.* Have students pair up with another individual or group to share their concept maps. Focus discussion on the choices made in constructing the map and when there were debates or questions about placement or connections.

Uses and Variations

In sorting, one can choose classifications other than most-to-least important. For instance, one might group ideas according to those that appear first or need attending to first and those that come later or those ideas common to all versus common to some. Some students have devised a series of concentric circles to help in this grouping, creating inner and outer rings of influence.

Jenny Rossi used GSCE with a small group of third graders at Way Elementary in Bloomfield Hills, Michigan, to assess what they had learned through their geometry study. She asked students to collectively generate a list of all the things they had studied. As students came up with ideas, Jenny gave them index cards to write them on. Jenny then laid out the cards and asked her students to sort them, not by centrality, but just by those ideas that seemed to have something in common. This provided Jenny insights into the kinds of attributes students found significant. For instance, in grouping shapes, the students focused on the number of sides and put symmetry with lines and rays since they had talked about "lines of symmetry." Having the ideas on index cards meant that these groupings could be done flexibly and changed if need be. Jenny then asked the students to talk about how these groups were connected and she recorded this information on the connecting line. For "Elaborate," Jenny told students they would be studying pyramids and prisms next, and after that study would come back to the concept map to add this new information.

When history teacher Sharonne Blum wanted her grade 9 students at Bialik College to study for exams, she decided to use the steps of Generate-Sort-Connect-Elaborate. At the start of the period, she kept all students outside the classroom, allowing only two to three of them in at a time. As the first group of students entered, they were asked to add an idea to the topic that had been written on the whiteboard, "Jewish Life in the Middle Ages," placing central and important ideas toward the center. Two or three at a time, students added their ideas, naming an event they knew about or expressing a theme, concept, or idea. As more groups entered, instructions were shifted, and the later entering students were asked to read what had been written and draw lines to show connections among events, concepts, or ideas. At this point, with all students in

the room, the class was invited to add additional ideas, connections, or elaborations. Sharonne then used the concept map students had created as the basis for their review, asking if anything was missing or if there was any disagreement about placements. When students were asked what questions came up for them, an interesting discussion ensued. "Why do we always consider tragedy and disaster more important than happy peaceful times?" one student asked, having noticed that the tragic events were all placed much closer to the center. With that comment, students began to discuss how turning points in history are often triggered by disaster. They also spoke about human nature and how we tend to focus on the negatives in our lives and take for granted the positives.

Assessment

The concept maps created using GSCE contain a wealth of assessment information about what students know and how they see that knowledge related and connected to the whole. Notice the ideas generated and their placement on the map. Are students able to differentiate between key ideas and peripheral ones? Have they identified the most important ideas? The way the ideas are elaborated gives an indication of the depth of learners' understanding. What sort of connections are students making? Look for connections that are more than the obvious and show insights in the deep structure of the ideas. If the topic is a familiar one, GSCE can be done as an informal pre-assessment and again at the end of the unit to see how students' thinking has developed.

Tips

Creating a good concept map depends on generating a good list of ideas with which to work. To ensure this, you might want to have students generate initial lists individually and then work in pairs or small groups. This allows for combining lists to "Sort." Of course, although "Generate" exists as its own step, students can add additional ideas at any time. Practically speaking, it is useful to have large sheets of paper for students to write on. The size of the sheet will draw attention to placement and provide a greater range of possibilities. In addition, students will find it easier to write their connections and to elaborate ideas if the sheet is large enough to accommodate these moves.

A Picture of Practice

One of the assigned novels for Ravinder (Ravi) Grewal's grade 12 English classes at Bialik College, is Tim O'Brien's *In the Lake of the Woods*. The book's protagonist, John Wade, is a Vietnam veteran who is emotionally unstable. This complex book provides an opportunity to hone students' skill at character analysis, a skill that will be tested in their state exit exams.

After reading and discussing the text, Ravi wanted students to analyze the factors contributing to John Wade's mental breakdown. Rather than merely directing her students to write an analytic essay, Ravi decided to use the GSCE routine to help structure students' thoughts and begin their analysis. She also thought the routine would provoke lively discussion that would encourage her students to reexamine their own ideas. "I wanted a structure that would give students the freedom to air different viewpoints, make connections, and arrive at conclusions without fear of being incorrect. I also wanted them to be the main participants in the discussion and not allow it to become a teacher-directed one."

As this was the first time Ravi had used GSCE with her class, she was explicit with directions: "Individually, I would like you to generate some ideas. Think of all the factors that impacted on John Wade as an individual and compile a list of those." After giving her students time to do this, she gave the next instruction: "Place the ideas which you consider most important close to the center and those that are peripheral place further away from the center in descending order of importance." Ravi then went on to direct the students to draw connecting lines between factors that somehow complemented or influenced each other. Finally, she asked students to elaborate their ideas, adding details that would further their understanding. (See Figure 5.4 for an example of a student's GSCE concept map for the character of John Wade.)
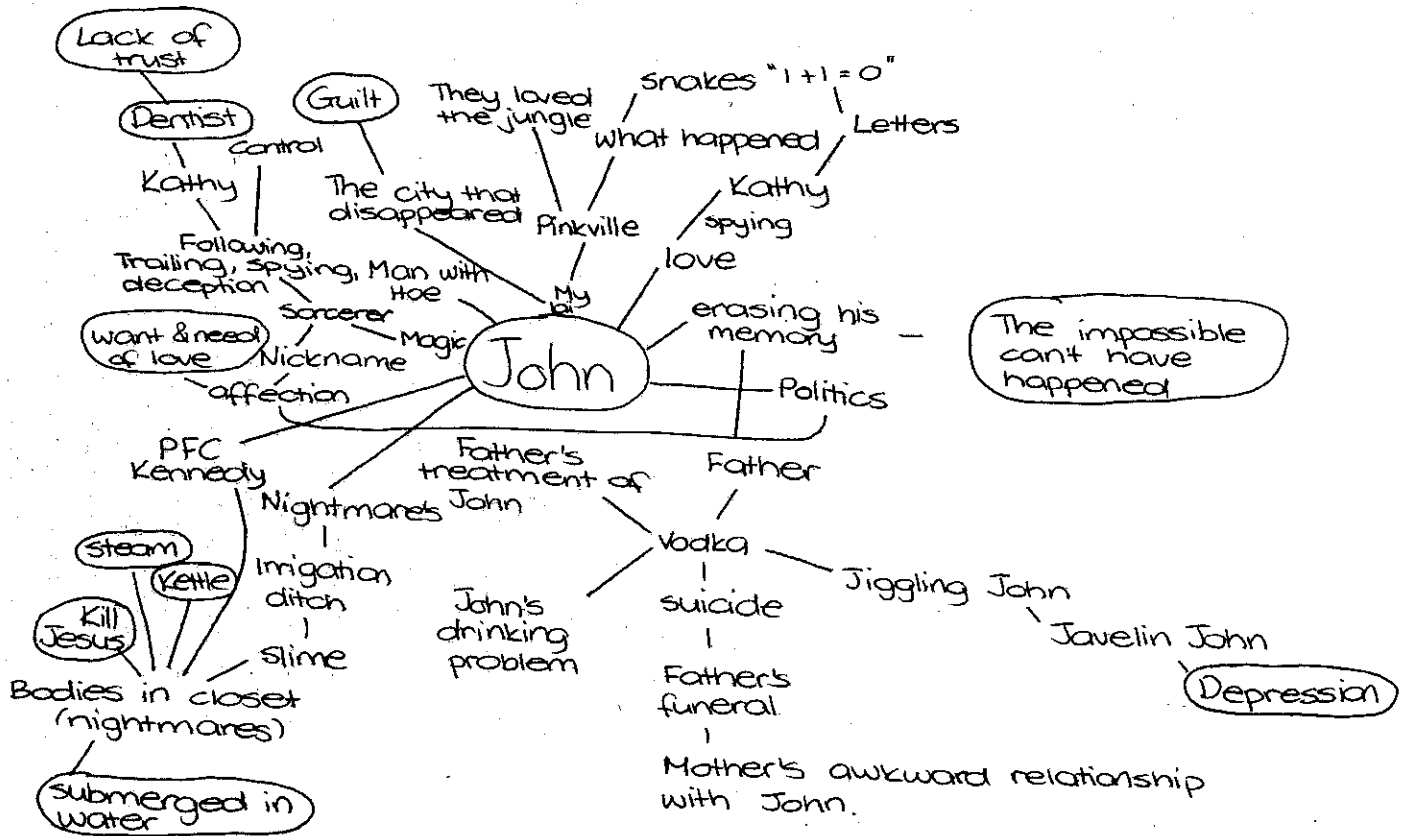
After completing individual concept maps, students were placed in small groups and asked to make a collective concept map following the same steps. "They had to arrive at a consensus before placing an idea in a particular place during the 'Sort' stage. This encouraged a passionate discussion as each felt strongly that he or she had the most accurate 'spot.' That debate was exactly what I was looking for," Ravi commented.

In observing students in their groups, Ravi was impressed with the quality of the conversations: "The debate that occurred when they were creating the group concept map from their individual ones allowed the relative importance of each contributing factor to be discussed, further clarifying the ideas to the students. The 'Sort' stage was the most effective as it generated the most discussion. The 'Connect' stage was another one that opened up so many new ideas that the students themselves were surprised at the number of layers they had uncovered."

One particularly lively debate was that which focused on the question of whether it was Wade's experience in Vietnam that sent him over the brink or whether his breakdown was the result of his father's bullying during his childhood.

Figure 5.4 Tyrone's Concept Map for the Character John Wade from *In the Lake of the Woods*

GENERATE SORT CONNECT EXTEND - CONCEPT MAP

Lack of trust — Dentist — Guilt — Control — Kathy — They loved the jungle — snakes "1+1=0" — what happened — Letters — Kathy — spying — love — The city that disappeared — Pinkville — erasing his memory — The impossible can't have happened — Following, Trailing, Spying, deception — Man with Hoe — Sorcerer — Magic — want & need of love — Nickname — affection — My Lai — **John** — Politics — Father — PFC Kennedy — Father's treatment of John — Nightmares — Irrigation ditch — Steam — Kettle — Kill Jesus — Slime — Bodies in closet (nightmares) — Submerged in water — John's drinking problem — vodka — suicide — Father's funeral — Mother's awkward relationship with John — Jiggling John — Javelin John — Depression

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The students discussed the possibility that if his father hadn't bullied him and taken away his self-esteem as a child, would he have grown up strong enough to withstand the trauma of the Vietnam War? There was great conflict over this idea, with some students saying that no one could have experienced the trauma of the My Lai massacre and not have been traumatized.

In reflecting on students' understanding, Ravi observed, "Their final analysis was that all the factors were 'significant and Wade's response to each one was similar and in keeping with the strategy he had perfected in his childhood. This was exactly what I wanted them to understand. I did not want them to see Wade as either a damaged war veteran only or merely as a child affected by his abusive father. And they really got it! When they finally concluded that all individuals are capable of this evil given the circumstances, I knew they had understood the core issues here."

At the end of this 90-minute class, which you can see a portion of on the DVD, students were asked to write an essay discussing, "Is John Wade a monster or is his only fault the fact that he is a man?" The writing of the essay took place the next day. Ravi clearly saw how the structured process of the routine and the ensuing discussion were reflected in the students' essays. "Because they had explored so many factors, they realized that an individual is an outcome of a range of experiences and therefore one cannot form an opinion that condemns an individual as a monster. One must begin to understand that all humans are flawed and the flaws become apparent as a result of their experiences."

Reflecting on her students' first use of the routine, Ravi noted, "I found the students more willing to indulge in discussion, to listen, and to search for reasons that had led them to the decisions they had made when working individually. Thus they saw alternative viewpoints, but still had firm views of their own. What surprised me was the rational way in which they willingly engaged in debate but were willing to be convinced if they saw reason in the other person's viewpoint. I was really pleased at the structure provided by the routine, and the fact that the students saw that concept maps have a structure that reflects their mental moves—generating, sorting, connecting, elaborating!"

In reflecting more broadly on her use of routines, Ravi commented, "Thinking routines have enabled me to plan, keeping in mind the 'thinking' I want my students to do, given me structures and encouraged students to adopt these 'moves' in their approach to any form of literary analysis without directions from the teacher. They are moving toward independent thinking as they are now giving the appropriate 'signal' to their 'brain,' instructing it to 'connect' or 'sort' or explore the reason behind their conviction by asking themselves, "What makes you say that?""