WHAT STRATEGIES DOES THE RESEARCH SUGGEST?

The following strategies offer ways for instructors to assess their own knowledge organizations relative to students' and help students develop more connected, meaningful, and flexible ways of organizing their knowledge.

Strategies to Reveal and Enhance Knowledge Organizations

Create a Concept Map to Analyze Your Own Knowledge Organization   It can be difficult for experts to recognize how they organize their own knowledge, and thus difficult for them to communicate this organization to students. One way to make your own knowledge organization apparent to yourself is to create your own concept map. Concept mapping is a technique that helps people represent their knowledge organizations visually. (See Appendix B for more information on what concept maps are and how to create them.) Once you have produced your own concept map, the central organizing principles and key features you use should be easier for you to recognize. You can then walk your students through your own concept map as a way of orienting them to the organizational structures in your domain and to illustrate the principles and features around which you want your students to organize their own knowledge.

Analyze Tasks to Identify the Most Appropriate Knowledge Organization   Different tasks draw on different kinds of knowledge organizations. For example, a paper that asks students to analyze the theoretical perspectives of different authors may

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require students to organize their knowledge around theories and the ways they shape research and writing, whereas a paper that requires students to analyze the impact of a historic event demands that they organize their knowledge around economic, political, and social factors. Thus, it can be helpful to analyze the tasks assigned to determine what kind of knowledge organization would best facilitate learning and performance. Then you might consider providing your students with a skeletal outline or template for organizing their knowledge. For example, in the case of the theoretical paper described above, you might give students an empty table in which you ask them to identify different theoretical schools in one column, describe the key characteristics of each school in the next column, and list scholars whose work would fall into each in another column (including, perhaps, a column to list ways in which each scholars' work does not conform to the theoretical norm).

Provide Students with the Organizational Structure of the Course   Do not assume that your students, especially those who are new to the content area, will see the logical organization of the material you are presenting. They may not see basic relationships or category structures. Therefore, providing students with a view of the "big picture" that presents the key concepts or topics in your course and highlights their interrelationships can help students see how the pieces fit together. This organizational structure can be communicated in your syllabus in various ways: some instructors represent it visually (for example, through a flow chart or diagram) whereas others communicate it verbally. In addition to presenting and explaining this organization early in a course, periodically remind students of the larger organizational framework and situate particular class days within it (for example, "If you'll remember, the first unit of this course focused on developing basic negotiation skills. Today we will be starting the second

unit, in which we will see how those skills apply to real world work situations.")

Explicitly Share the Organization of Each Lecture, Lab, or Discussion   Because students' knowledge organization guides their retrieval and use of information, it is especially beneficial to help students create a useful organization as they are learning. To this end, providing an outline, agenda, or visual representation of each lecture, lab, or discussion session can give students a framework for organizing the information they are about to learn. Not all outlines or agendas are equally effective for helping students develop meaningful and connected knowledge organizations, so be sure that the organizational structure you provide captures the critical concepts or principles around which you want students to organize the information from the class. (For example, an agenda that includes headings such as "Introduction," "Lecture," "Discussion," and "Recap" is considerably less useful than an agenda entitled "Three rules to guide ethnographic fieldwork, the reasons for these rules, and a discussion of their limitations.")

Use Contrasting and Boundary Cases to Highlight Organizing Features   To help students develop more sophisticated and nuanced ways of organizing knowledge, it can be useful to present contrasting cases, or two items that share many features but differ in critical ways. Although cases are often used in teaching, they tend to be most effective when presented not in isolation but rather with some compare-and-contrast analysis. A simple example would be a comparison of sharks and dolphins, which have many similarities but represent different classes of animals. Presenting two such cases together makes the differing features more salient and helps students develop deeper and more finely articulated knowledge structures (for example, instead of organizing animals superficially by habitat, they begin to organize them according to

other features: vertebrate versus nonvertebrate, warm-blooded versus cold-blooded, live births versus egg-laying, and so forth). Along the same lines, highlighting boundary cases or anomalies (or otherwise commonly misclassified items) can help students identify the salient features of a particular category and develop more nuanced knowledge organizations. For example, the platypus, as an egg-laying mammal, defies some aspects of mammalian classification while possessing other mammalian attributes. Pointing out cases like this focuses students on the critical elements of a particular classification scheme. The use of anomalies also alerts students to the limitations of taxonomies themselves, which can encourage them to develop alternative knowledge organizations.

Explicitly Highlight Deep Features   In order to help students develop more meaningful and less superficial knowledge organizations, highlight the deep features of problems, designs, theories, and examples. One way to do this is to provide examples of problems that share deep features but differ superficially, or examples of problems that are superficially similar but operate on different structural principles. The use of such comparisons can help students become more adept at identifying underlying features and principles and thus teach them to organize their knowledge more meaningfully.

Make Connections Among Concepts Explicit   As you introduce a new concept (or design, theory, example, or problem), explicitly connect it to others students have learned (for example, "You may remember encountering a similar situation in the case study we read last week"). The connections you draw do not always have to be similarities; they can also be contrasts or discrepancies (for example: "What makes this artist's work so different from

other abstract expressionists?"). In addition to pointing out these connections yourself, it is important to ask questions that require students to make these connections themselves (for example: "Where have we seen this theoretical orientation before?" "What aspects of this case are similar to or different from the labor management case we discussed yesterday?" "What characteristics of this artist's work are reminiscent of the Bauhaus approach?").

Encourage Students to Work with Multiple Organizing Structures   To enable more flexible application of knowledge, students need to develop multiple knowledge organizations that they can draw on as appropriate. One way to help students develop multiple representations is to ask them to categorize a set of items according to more than one organizational schema; for example, you might ask students to classify plants first on the basis of their evolutionary histories and then on the basis of native habitat. This classification task could then be followed by questions that illuminate the implications of organizing knowledge one way or the other. For example, a taxonomy based on evolutionary history might be useful for paleontological analysis, but not for designing a green roof. Giving students practice organizing their knowledge according to alternative schemata or hierarchies helps them see that different organizations serve different purposes and thus builds more robust and flexible knowledge organizations.

Ask Students to Draw a Concept Map to Expose Their Knowledge Organizations   Asking students to create concept maps gives you a window not only into how much students know about a particular subject, but also how they are organizing and connecting their knowledge. Concept maps are a visual representation of a knowledge domain (see Appendix B for more information on what concept maps are and how to create them). A

concept-mapping activity can be used at the beginning of a course—to reveal students' prior knowledge organization—and then in an ongoing manner to monitor how that organization changes with time and experience. Concept maps, whether graded or ungraded, can help you diagnose problems in students' knowledge organization; for example, if they have miscategorized pieces of knowledge, inappropriately linked unrelated concepts or failed to connect related concepts, or assigned an item to a superordinate position that belongs in a subordinate position, and so on.

Use a Sorting Task to Expose Students' Knowledge Organizations   Another way to expose students' knowledge organizations is to ask them to sort different problems, concepts, or situations into categories. This method reveals how students organize their knowledge without requiring them to identify their sorting criteria explicitly. One example of a sorting task is presenting students with a set of problems that have some superficial and some deep features in common, and asking them to group the problems according to similarities. If students group projects on the basis of superficial similarities, it is an indication that they do not recognize the deep features that would help them develop more meaningful and flexible knowledge organizations.

Monitor Students' Work for Problems in Their Knowledge Organization   One way to detect problems in students' organization of knowledge is to pay attention to the patterns of mistakes they make in their work for your course. For example, do students frequently mix up two conceptual categories (such as confusing theories and methodologies or force and acceleration problems)? Do they apply a formula, strategy, or solution in a consistently inappropriate way? If so, it is possible that students are making inappropriate connections or categorizations that are impeding their learning and performance.

SUMMARY

In this chapter, we have reviewed research pointing to the fact that it is not just *what* you know but *how you organize* what you know that influences learning and performance. Knowledge organizations that include more interconnections and that are based on deep and meaningful features tend to be effective in supporting learning and performance. Another key aspect of effective knowledge organizations is that they are well matched to the task(s) at hand. For this reason, rich and meaningful knowledge organizations are very helpful. Experts often take advantage of these aspects of their knowledge organizations. However, students—especially ones who are new to a discipline—tend to have knowledge organizations that are sparsely interconnected and that are based on superficial features. These students can benefit from instruction that helps them to see important relationships and build more connections among the pieces of knowledge they are learning, thus leading them to develop more flexible and effective knowledge organizations.