Many university faculty design and upload course materials to the web using either their own website or a course management system. They typically present content in a linear or sequential structure, using hyperlinks to access course files, websites, and folders. Sequential ordering of content employs chronological or alphabetical order, or arranges content from general to specific. This approach ignores the adage that “a picture is worth a thousand words.” If a picture is worth a thousand words, it is because a visual image can generate more cognitive associations that enhance critical thinking and memory than can words by themselves.

E-maps visually represent complex information in an easy-to-understand format that shows the overall structure of subject content. I use the term e-maps for computer-generated mind maps, which were created by Tony Buzan in the late 1960s to help students take better notes using key words and images.1 The mind forms associations almost instantaneously, and the mind map approach helps students quickly relate a central word or concept to other pieces of information. A mind map makes information more meaningful than if it were just memorized because, like concept maps, it places the information in the context of existing knowledge. Furthermore, a mind map allows instructors to organize information into chunks, enabling students to remember more information for a longer time. (See http://heuristixx.wordpress.com/ for examples of hand- and computer-drawn mind maps.)

E-maps can organize and sequence content nonlinearly on one web page by placing the main topic in an image-centered diagram with interrelated main and subtopic connections or branches in a radial format. E-mapping thus offers a powerful e-learning and organizational technique that visually displays main topics, subtopics, concepts, and images and the relationships between them.

E-Maps and Meaningful Learning

Mind maps and concept maps provide a powerful visual image that can depict complex relationships and information and relate new information to prior knowledge. Many learning theories and research studies support the effectiveness of using graphic organizers such as mind maps and e-maps to facilitate learning. An e-map can be used on the web to quickly create concise represen-
tations of ideas, complex relationships, knowledge, and information.

Graphic organizers are particularly suited to:

- Aiding learning by explicitly integrating new and old knowledge
- Generating ideas through brainstorming
- Assessing understanding or diagnosing misunderstanding
- Increasing recall
- Designing a complex structure (long texts, large websites)
- Communicating and understanding complex relationships

Grounded in learning theory and research, concept maps and mind maps are based primarily on the learning theories of cognitive psychologists, specifically David Ausubel’s assimilation theory and James Deese’s associationist theory.

The primary concept in Ausubel’s assimilation theory is meaningful learning. According to Ausubel, “The most important single factor influencing learning is what the learner already knows.” Thus, meaningful learning results when a student relates new knowledge or information to what he or she already knows (existing knowledge). Ausubel contrasted meaningful learning to rote learning, which occurs when a student simply memorizes information with no attempt to relate that information to prior learned knowledge. The new information is easily forgotten and not easily applied to problem-solving situations because it was not linked to concepts already learned.

Meaningful learning anchors new ideas or concepts with previously acquired knowledge in a nonarbitrary way. The associationist theory states that memory consists of a network of concepts that is not hierarchical despite being supportive of hierarchies. Relationships between concepts form naturally when two concepts overlap on some dimension. As learning occurs, this network of concepts and relationships becomes more and more complex. Regardless of the theory behind it, a concept map helps represent ideas in a way that models an individual’s cognitive structure.

### Other Research

Much research has investigated how using graphic organizers such as concept maps and mind maps can facilitate learning by using a pictorial way of constructing knowledge and organizing information. The following list summarizes notable theories and studies that support graphic organizers in the teaching and learning process:

- Use of graphic organizers aids students in retention and recall of information.
- Semantic networking tools enhance comprehension and retention of the ideas being studied by helping learners construct structural knowledge. In addition to improving comprehension, structural knowledge improves retention of content being studied.
- Concept maps help preservice teachers map their subject-matter knowledge as a precursor to lesson planning.
- Students demonstrate some of their best thinking when they try to represent something graphically, and thinking is a necessary condition for learning.
- The effects of graphic organizers are greatest when students have in-depth instruction and training in their use and when students construct graphic organizers themselves.

### E-Mapping Software

In 1993, Mindjet released MindManager, one of the first professional mind mapping or e-mapping software programs developed for business, education, and corporate training. A MindManager map can be exported as a clickable image map, an image, PDF file, PowerPoint presentation, Word document, or web page. Today many e-mapping software companies offer products on both PC and Mac platforms (see Table 1).

<table>
<thead>
<tr>
<th>Company</th>
<th>Program</th>
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<td><a href="http://www.conceptdraw.com">http://www.conceptdraw.com</a></td>
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Creating an E-Map

One advantage of working with e-mapping software is its ease of use. You do not need advanced computer skills to learn how to use the software—if you can create a PowerPoint presentation, you can easily learn to create e-maps for instructional modules.

Constructing an e-map involves seven basic components:

1. A central or module topic is automatically added to every new map.
2. Main topics branch off the module topic. These should be the main content related to the topic.
3. Subtopics provide details about the main topic.
4. A relationship exists between two (or more) topics.
5. Link to an existing file (including another map), Web page, or folder.
6. Callout topics can be used for comments or to provide additional information for a specific topic.
7. Floating topics can be used for comments or to label the map.

Figure 1 shows a sample e-map using all seven components.16

Color and graphics are important attributes in designing e-maps. Color can be used to reinforce associations, differentiate categories or topics, depict themes, and make relationships stand out. Graphic images and other visual aids such as arrows and icons serve an organizing function by illustrating the relationships between similar and different topics (see Figure 2). To see use of color and graphics in an e-map, see http://www.mapacourse.com/flash_planet_movie/virtual_field_flash_trips_MM/index.html.

Instructional Applications

E-maps can be created for a whole
A course, a course module, or a special topic within a module. Using an e-map enables the instructor to design instruction showing the interrelationships of content and complex concepts by linking websites, word processing and PDF files, PowerPoint presentations, video clips, Flash movies, and many other files. The instructor can use an e-map during a classroom presentation or as a study guide on a particular topic.

**E-Maps for the Web**

To use an e-map as a graphical interface for web pages and files, you first need to create a website for all your web pages. You can keep all web pages and files in one location, readily available for quick editing and uploading to a server. Using a web authoring program such as Adobe Dreamweaver can aid this process. A completed e-map can be exported as a clickable image map web page (see Figure 3). The exported image map is saved in the website’s root folder (see Figure 4). The relevant web pages and files can then be linked to the e-map.

**E-Map Planning and Examples**

Before creating an e-map, the instructor should formulate objectives for the module or topic. The objectives then serve as a guide for creating e-map topics and subtopics. Figure 5 shows an example e-map created for a module on the planets (also shown in Figure 4). Each planet branch extends out from the sun and includes a numerical position from the sun, a picture of the planet, a callout indicating the
distance from the sun, a PowerPoint presentation on the planet, and hyperlinks to websites that correspond to each planet.

Figure 6 shows an e-map created to teach students about the moon. Each branch extends out from the moon image, including nine branches with an interesting fact about the moon, a branch with web links to information on the moon, a branch that attaches to a picture of the moon’s phases, and branches hyperlinked to a video clip on the moon, PDF articles about the moon, and a PowerPoint presentation on the moon.

**Conclusion**

An e-map provides an outstanding e-learning tool for organizing and navigating web-based content and files. Considerable research indicates the effectiveness of using graphic organizers such as mind maps to facilitate meaningful learning. Buzan and Buzan argue that mind maps better harness the way the brain works than traditional linear constructions of knowledge presented to students. The radiant structure of an e-map is consistent with the radial nature of the brain’s functioning, and the colors, graphics, and nonlinear branches used in an e-map stimulate the entire brain, resulting in more engaged and effective learning. Using the e-map technique gives instructors the freedom to express ideas and show interrelationships between concepts and content in a very visual and nonlinear structure that benefits their students.

**Endnotes**

2. Very active in his field during the 1950s to 1970s, Ausubel was influenced by Piaget’s cognitive development theory. See David P. Ausubel, *The Psychology of Meaningful Verbal Learning* (New York: Grune and Stratton, 1963).


16. I created all the figures in this article using Mindjet’s MindManager Pro 7.


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