Faculty developers can help faculty learn to intentionally sequence assignments and activities to promote greater learning when they understand the convergent research—with its practical implications for teaching—on how people learn, on deep learning, and on cooperative learning. Such a sequence includes a motivating out-of-class assignment (homework), in-class “processing” that includes active learning and student interactions, and feedback and assessment, often given in multiple ways. This approach is modeled through two examples using graphic organizers.

Faculty are always looking for ways to teach better and “smarter.” They don’t want gimmicks or quick fixes or even worse, they don’t want to feel overloaded by trying to respond to simultaneous teaching demands, such as teaching for critical thinking, diversity, writing across the curriculum, and so on. They—and those of us in faculty development—know that simply splicing these new elements into existing courses without a clear sense of purpose, commitment, or competence will simply result in incoherence and a lack of alignment between goals, assessment, and activities (see Robertson, 2003).

Faculty members are more likely to be motivated to change their teaching practices when they have confidence in a research-based integrated approach to teaching and learning. Palmer (1997) reminds us that
Our challenge is not to reduce good teaching to a particular form, model, methodology, or technique, but to understand its dynamics at the deeper levels, the underpinnings, to understand the dynamics that make connectedness a powerful force for learning in whatever forms it takes. (p. 12)

Similarly, Leamnson (1999) emphasizes that “a good pedagogy selects what is appropriate and is not wedded to a method, no matter how innovative or popular” (p. 8).

This chapter therefore offers faculty developers—who can then share with faculty—an intentional approach to learning and course design that is based on integrated and synthesized research from three fields: the eclectic research on what is sometimes called “how people learn,” the international research on deep learning, and the longstanding research on cooperative learning, which includes both pair work and small group work.

Faculty can be coached to sequence activities—both outside and inside the classroom, with implications, too, for distance education—in order to strengthen student learning and motivation to learn. They need to create motivating homework assignments—remembering that students are motivated by assignments with relevance to their own lives—to get students involved with the course content. They then need to use classroom or distance education interactions to reinforce that content. These reinforcing activities get students actively working together on academic tasks that build on the foundational homework. It is important, as Marton, Hounsell, and Entwistle (1997) point out, that we view

The teaching-learning process as a constellation of learning tasks, some of which take place in a classroom setting in the presence of a university teacher while others are pursued alone or in the company of peers in the university library, the study-bedroom, or even in the course of travelling [sic] to and from campus. (p. 247)

To bring research into practice, we will examine two specific examples from different disciplines with suggestions for further use in other contexts. First, to provide background information, we need to examine the research on how people learn, which leads us to a multilayered look—almost like hypertext—at deep learning, which in turn suggests that cooperative learning can provide a seamless approach to the active learning and student interactions needed for deep learning.
The Research and Premises Behind How People Learn

Bransford, Brown, and Cocking (2000) have assembled a groundbreaking report that looks at how people learn through convergent research from a variety of fields including cognitive psychology, developmental research, social psychology, neuroscience, and technology. They note that "one of the hallmarks of the new science of learning is its emphasis on learning with understanding" (p. 8).

According to Bransford et al., three research-based findings have profound implications for how we structure learning with understanding. The first finding involves prior knowledge:

...The contemporary view of learning is that people construct new knowledge and understandings based on what they already know and believe...[and thus]...teachers need to pay attention to the incomplete understandings, the false beliefs, and the naive renditions of concepts that learners bring with them to a given subject. (p. 10)

The second finding coalesces perfectly with the international research on deep learning. The finding is that to teach for understanding, not memorization—which these researchers identify with deeper learning—teachers must eschew breadth in coverage in favor of depth. Students need a deep foundational knowledge, but the knowledge base needs to be organized around conceptual frameworks to facilitate retrieval and application. The third finding, which is emphasized repeatedly in the book, is the value of metacognition—getting students to think about their thinking—a practice that makes them self-aware learners better able to solve problems and to transfer knowledge from one arena to another.

Because it is so critical, Bransford et al.'s second learning principle—deep, conceptual learning—deserves a closer look.

The Research and Premises Behind Deep Learning

International research on deep learning has been ongoing in a number of countries including Britain, Sweden, Australia, and New Zealand. Four key components characterize a deep, rather than a surface, approach to learning. Rhem (1995) summarizes them as follows:

Motivational context: We learn best what we feel a need to know. Intrinsic motivation remains inextricably bound to some level of choice and control. Courses that remove these take away the sense of ownership and kill one of the strongest elements in lasting learning.
Learner activity: Deep learning and "doing" travel together. Doing in itself isn't enough. Faculty must connect activity to the abstract conceptions that make sense of it, but passive mental postures lead to superficial learning.

Interaction with others: As Noel Entwistle put it in a recent email message, "The teacher is not the only source of instruction or inspiration." Peers working as groups enjoin dimensions of learning that lectures and readings by themselves cannot touch.

A well-structured knowledge base: This doesn't just mean presenting new material in an organized way. It also means engaging and reshaping the concepts students bring with them when they register. Deep approaches and learning for understanding are integrative processes. The more fully new concepts can be connected with students' prior experience and existing knowledge, the more it is they will be impatient with inert facts and eager to achieve their own synthesis. (p. 4)

This research strongly reinforces the need to think intentionally about how we structure and sequence assignments and activities so that we capitalize on motivating students to tackle our content as preparation for class and then reinforcing that preparation through meaningful social learning exchanges with peers. Another emphasis in Bransford et al.'s work is the importance of community in learning:

Teachers must attend to designing classroom activities and helping students organize their work in ways that promote the kind of intellectual camaraderie and the attitudes toward learning that build a sense of community. (p. 25)

Thus, the research on cooperative learning has enormous relevance as teachers sequence activities for deep learning. Cooperative learning—because of its structure and its emphasis on metacognition/monitoring—provides a valuable way to build in the peer interactions and active learning that are the heart of deep learning.

The Research and Premises Behind Cooperative Learning

Cooperative learning, like collaborative learning, entails small groups working on specific tasks. It seeks to overcome some of the weaknesses of traditional small group approaches by structuring activities carefully. Cooper
To Improve the Academy

(1990), in fact, regards the key to successful cooperative learning as “Structure! Structure! Structure!” (p. 1).

Two basic premises govern all cooperative classrooms. The first is positive interdependence. Students have vested reasons to work cooperatively together on tasks or problems too complex for one individual to complete. Through careful planning, teachers can establish positive interdependence by having students achieve mutual goals, such as reaching a consensus on specific solutions to problems or arriving at team-generated solutions; mutual rewards, such as individually assigned points counting toward a criterion-referenced final grade, points that only help, but never handicap; structured tasks, such as a report or complex problem with sections contributed by each team member; and interdependent roles, such as having group members serve as discussion leaders, organizers, recorders, and spokespersons.

The second premise is individual accountability. No matter how much mutual support, coaching, and encouragement they receive, students must be individually responsible for their own academic achievements. Teachers can grade quizzes, projects, and final exams just as they would in a class where group work is not the norm. When teachers assign group projects, they must avoid merely stamping a grade on the final product. Ethically, they must determine the contributions of each member and assign grades accordingly. Most teachers use a combination of peer, individual, and teacher assessments.

Additionally, some other premises, which lead to deliberate practice, can promote effective cooperative learning. Heterogeneity in teams or pairs helps build the skills needed for critical thinking. Brookfield (1987) and others have emphasized that critical thinking depends on identifying and challenging assumptions and subsequently exploring and conceptualizing alternatives. These challenges will not occur when students all think alike. Group heterogeneity also helps students build needed workforce and community skills by learning to value the contributions of others.

It is also important to build in group processing activities so that students acquire teamwork skills and the metacognitive skills advocated by Bransford et al. that help them become intentional learners. Cuseo (2003) notes:

Such meta-cognitive processing involves student reflection on:
(a) individual steps involved in their thinking or problem-solving,
(b) specific strategies or approaches they used in the process of reaching problem solutions, and, (c) underlying rationales for their ideas. (p. 73)
Some good resources for cooperative learning are Cooper, Robinson, and Ball (2003); Johnson, Johnson, and Smith (1991); Millis (2002); and Millis and Cottell (1998).

Sequencing Activities and Assignments

Bransford et al. conclude that "The emerging science of learning underscores the importance of rethinking what is taught, how it is taught, and how learning is assessed" (p. 13). Teachers who understand this emerging science of learning—including the premises behind the brain-based, deep learning, and cooperative learning research—are prepared to bring theory into practice through intentional sequencing. Walvoord (2004) suggests that faculty can teach well and save time by using in-class time for what she calls "process and response." When they deliberately sequence materials by assigning motivating homework that is then "processed" in class through active learning and peer interactions, students can learn at a deep level.

The two examples that follow illustrate the process of sequencing, both of them using graphic organizers. A graphic organizer can be defined as a diagram to organize information in a visual format that suggests relationships. Particularly common in science and engineering, graphic organizers are useful because they provide organizing principles or prompts that can focus homework assignments. Bransford et al. point out that novice learners do not have the "command of concepts" held by experts (p. 17) whose thinking is guided by "core concepts" and "big ideas" (p. 37). Thus, graphic organizers can help students, who are not experts, to see patterns and relationships. Marzano, Pickering, and Pollock (2001) recommend graphic organizers based on "six common patterns into which most information can be organized: descriptive patterns, time-sequence patterns, process/cause-effect patterns, episode patterns, generalization/principle patterns, and concept patterns" (p. 75).

Example 1: Using a Graphic Organizer Called a Double Entry Journal

With a double entry journal (DEJ) students identify on the left side of a grid (a Word table template emailed or distributed to students) the key points of an article, chapter, or guest lecture. Just opposite the key point they respond, linking the point to other academic material, to current events, or even to their personal experiences and opinions (see Figure 15.1).
FIGURE 15.1
Sample Double Entry Journal (Two Points Cited Only)

| Key Points                                                                 | Responses                                                                 |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Mental health issues—including suicide and depression—are growing on campuses, requiring more resources to solve them. | I have been hearing this for years, particularly from teachers in schools with open enrollments. Resources are always an issue, it seems, no matter what the problem. As a faculty developer, I want to see—selfishly—more resources spent to bolster teaching. But, on the other hand, if the students we attempt to teach have barriers to learning that transcend the classroom, then more needs to be done. |
| Fortunately, most common problems, including eating disorders, substance abuse, and anxiety, are treatable but only if students recognize the symptoms and seek help. | I think faculty and teaching assistants can definitely help in this arena if they recognize key symptoms and steer students toward the appropriate resources. I am glad we are adding this semester a new mental health component to our three-day TA training. I will now be certain that we continue to offer workshops on "Distressed and Distressing Students." |

Name: Barbara J. Millis

Article: "The Mental Health Crisis: What Colleges Must Do" by Richard D. Kadison (2004)

To avoid overloading students, faculty members can limit either the length of the DEJ or the number of key points.

A DEJ prepared outside of class gets students into the knowledge base and motivates them. Motivation is heightened with a DEJ for two reasons. First, when students know their homework will be reviewed by peers, they are more likely to come to class prepared (Nelson, 2004). Second, students often become motivated when the material is relevant to their own lives and learning, as when they write reflective responses to the key points in an article. These reflective responses also promote learning because students who place content knowledge in a personal context are more likely to retain the information and be able to retrieve it—the "self-referral" effect—(Rogers, Kuiper, & Kirker, 1977). Similarly, Jensen (2000) advises faculty members to help students "discover their own connections... [and] use their own words with regard to new learning" (p. 282).

What becomes of the out-of-class homework assignment is critically important. Too often, teachers merely collect and grade homework, suggesting
to students that their work is an artificial exercise intended for evaluation by a bored expert (the teacher). To avoid this perception and to build in the active learning and interaction with peers in the deep learning/cooperative learning models, teachers can pair students and have them read and comment on each other's DEJ. (Unprepared students do not pair, they work on their DEJ at the back of the room.) The paired conversations should lead to both learning and genuine exchanges. Intellectually, students should return to the original article or to their lecture notes to review the key points, particularly when there are dissimilarities. But the reflective responses, too, should prompt authentic connections. In a nursing class, for example, a student would react humanely when learning something personal about his partner: "Your Uncle Joe died of AIDS? I am so sorry."

The learning is further sequenced when the teacher provides feedback beyond the peer feedback offered through the paired discussion. Bransford et al. emphasize that "students need feedback about the degree to which they know when, where, and how to use the knowledge they are learning" (p. 59). Teachers can return DEJs with their own brief comments focused on the accuracy of the key points and the relevance and depth of the reflective responses. (Although marked, DEJs need not receive a labor-intensive letter grade: a pass/fail grade motivates students without adding significantly to the grading load. A "pass" counting 10 points toward a criterion referenced point-based final grade, for example, allows the teacher to comment quickly and personally, rather than justifying a grade based on the nuances between an A- and a B+.)

Feedback can also be provided through yet another stage in the sequence: whole-class feedback on DEJs. In this case, the teacher can share exemplary student DEJ examples or (my preferred practice) they can build a composite DEJ based on excerpts—key points and responses—from a variety of student examples. These exemplary DEJs are shared with the class ostensibly to coach students to write better DEJs in the future. But, as part of a sequence, this final stage also promotes learning through repetition without rote.

Two biologists help us understand the basics of learning and why sequencing is so important: Zull (2002) identifies the art of teaching as "creating conditions that lead to change in a learner's brain" (p. 5) and Leamnson (1999) defines learning as "stabilizing, through repeated use, certain appropriate and desirable synapses in the brain" (p. 5). Reading the assigned article or hearing the guest lecture is exposure one. Then, crafting the DEJ draws the student back into the material—with personally relevant responses—for repetition two. The paired discussion in class provides a third repetition. As a fourth repetition, students are likely to review their DEJ when the teacher returns them with comments. A fifth
repetition occurs when teachers coach students on preparing an ideal DEJ by presenting exemplary examples as an in-class follow-up.

Because DEJs are based on assigned readings or guest lectures (the lecturer will gain insights into how well students understood their presentation), they are useful in virtually any discipline.

Example 2: Using a Graphic Organizer With Jigsaw

Many courses involve demanding problem-solving skills that require students to confront complex, challenging topics involving multiple pieces of information necessary for final, overall mastery. Even if a definitive answer is neither possible nor desirable, students need to come to an understanding of in-depth issues. Cuseo (2003) suggests that if instructors seek to develop students' higher-order thinking skills, then the learning task should focus on "(a) ill-structured problems that may not be readily resolved, (b) issues to be discussed or debated, or (c) decision-making tasks that require exploration of, and determination from equally appealing alternatives" (p. 71). Such problems are ideally suited for the cooperative learning structure Jigsaw.

Jigsaw, like a DEJ, is carefully sequenced and monitored. Students prepare outside of class and bring their homework assignments to class where they work in a "home team" composed of students with various parts of the complex problem or issue. In a Jigsaw activity, students temporarily leave their home teams to form expert teams. In the expert teams students have two tasks: they must master the material, and they must also develop with other expert team members creative ways to teach the other members of their home teams the material they have mastered and respond knowledgeably and positively to questions raised by their teammates.

As an example, Jigsaw works well in literature classes where a key goal is to develop students' proficiency in close textual readings. After a mini-lecture on characterization that explains and models close textual analysis, the instructor assigns a literary work such as *Antigone* with four strong characters (Antigone, Creon, Haemon, and Ismene) and asks each student in a four-person home team to choose one character. (Teams can have more than four members; with five members, for example, two students can work with Creon, who is very complex.) To focus their reading, students receive a graphic organizer (McTighe, 1992) on which, as a homework assignment, they list each trait that describes their character on the extending arms. In the corner boxes they list (with page numbers) each episode or event that provides evidence for this trait (see Figure 15.2).
In the subsequent class meeting, all the students with the same character compare their graphic organizers in expert groups of three to five students. The team discusses the importance of the traits and the value of the supporting evidence and agrees on the best four traits and the best evidence to support them. Then, each member completes a second graphic organizer, using the best ideas of all members. Those familiar with the original Bloom's (1956) taxonomy will recognize that students are engaged in the highest levels of cognitive development because they are making judgments about the best traits (evaluation) and determining the most relevant evidence to create a new graphic organizer (synthesis). In a revised version of Bloom's taxonomy by Anderson and Krathwohl (2001), students still are working at the highest end of the cognitive process dimension because they are evaluating (making judgments based on criteria and standards) and creating (putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure).

At a signal, the expert members return to their home teams where they explain in depth their character's four key traits and the evidence in the text.
to support this interpretation. They are, in other words, teaching their teammates their portion of the Jigsaw, a practice that capitalizes on the use of peer tutoring to enhance learning (Fantuzzo, Dimeff, & Fox, 1989; Fantuzzo, Riggio, Connelly, & Dimeff, 1989).

As with a DEJ, students get individually involved with the materials through a homework assignment. But what becomes of the homework assignment is the key. In the expert groups, students are making judgments about the value of the traits and the evidence to support them. In addition to challenging them to think at the highest levels on the cognitive domain, this practice also helps students learn to attend closely to textual clues. They learn from one another in the expert teams by comparing and contrasting their different approaches to the same homework assignment and by preparing to teach their home team members. Gartner, Kohler, and Riessman (1971) emphasize that various cognitive processes occur when someone prepares to teach effectively. First of all, teachers must review the material, resulting—one assumes—in a deeper understanding. Second, teachers must organize the material in order to present it to others unfamiliar with it. In this process, they will likely seek creative ways to get the points across. They may discover or design, for instance, relevant anecdotes, concrete examples, visual or oral illustrations, graphic organizers, charts, and classroom or homework activities. Third, teachers are also likely both to identify and subsequently to reorder or rearrange the salient facts, resulting in in-depth understanding and, sometimes, in a reconceptualization of the subject.

The clarification and amplification, including stretching to find clearer examples, helps co-peers, students who teach other students (Whitman, 1988), to enlarge their own understanding. Webb (1983, 1991) has found that giving detailed, elaborate explanations increases student achievement. Additional benefits of peer teaching and coaching have emerged. Working with peers can reduce the sense of working in an isolated vacuum for an artificial audience, usually the teacher. Gere (1987), in speaking of the power of writing groups, emphasizes that

The peer who says "I don't understand" establishes—more powerfully than any theory, instructor's exhortation, or written comment can—the "otherness" of the audience and pushes writers to respond to this otherness by more effective ways to convey ideas. (p. 68)

Students receive pass/fail points for the individually prepared graphic organizer they brought to share in the expert team. It might be worth five points, for example, toward the final course point total. Even though the expert-team graphic organizer receives no additional points, it is collected
with the individual ones to be used for further feedback, as in the DEJ sequence. Bransford et al. emphasize the value of feedback based on thinking that is "made visible." Such feedback must "focus on understanding, and not only on memory . . . and does not necessarily require elaborate or complicated assessment procedures" (p. 140). Thus graphic organizers, such as the DEJ and the trait diagram, submitted for pass/fail points can contribute to student learning when they are part of a carefully organized sequence.

Jigsaws can be used in virtually any complex discipline. In a psychology class, for example, students can first explore as homework some research-based questions on the underpinnings of childhood moral development. These assignments could point them to the particular areas in which they will become experts: cognition, social, emotional, and biological. Each home team has an expert assigned to the particular topic area. These students delve into their particular specialty initially through homework or research assignments. Then they meet in expert teams with other people assigned to the same specialty to review their findings and to prepare to teach their topics. In their home teams composed of three or four experts, these students then teach their home team members the essence of their expertise. Other jigsaw examples might be botany students who can learn and teach others about the major plant groups (nonvascular land plants, seedless vascular plants, vascular plants with "naked" seeds [gymnosperms], vascular plants with flowers and protected seeds [angiosperms]). In other jigsaw examples, history students can learn from one another about photographers at Gettysburg (Gardner and his men, Mathew Brady, the Tyson brothers, and miscellaneous photographers such as Frederick Gutekunst and Peter and Hanson Weaver); anthropology classes can explore the various branches of the discipline (cultural, linguistic, physical, and archeology). Jigsaws can contain up to five pieces (more makes the sequencing and monitoring harder to manage) or can have only three, such as biochemistry students teaching each other about polymers of carbon (carbohydrates, lipids, and proteins).

Conclusion

Wiggins and McTighe (1998) discuss at length the importance of "sequence in the design of the curriculum" (p. 134). They argue for a "spiral" curriculum where "the same ideas and materials are revisited in more and more complex ways to arrive at sophisticated judgments and products" (p. 135). On the college level, ideas and materials can be sequenced through the intentional use of tools such as graphic organizers or carefully sequenced case studies, role
plays, and debates. The challenge—one where faculty developers can play a crucial role—is designing the sequence itself to capitalize on how students learn, deep learning, and cooperative learning.

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