



## Promoting Deep Learning

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As Laird, Shoup, Kuh, and Schwarz (2008, p. 471) point out, “faculty members, as the designers and facilitators of learning activities and tasks, play a key role in shaping students’ approaches to learning.” Bain and Zimmerman (2009, p. 10), for example, define “great teachers as those people with considerable success in fostering deep approaches and results among their students.” This paper provides research-based answers to these key questions:

- What is deep learning?
- Why should faculty adopt deep-learning approaches?
- What does deep learning look like? (examples and applications)

### What is Deep Learning?

Looking at students’ reading strategies, Marton and Saljo (1976) identified deep and surface approaches to learning. They discovered that students preparing for a test take two different approaches: Deep learners read for overall understanding and meaning; surface learners focus on stand-alone, disconnected facts and rote memorization. Bacon and Stewart (2006) postulate that “the issue of retention of deep or surface learning may have more to do with the amount of elaboration involved.” They give as examples of elaboration “finding additional examples, reworking homework exercises, and finding personal meanings” (p. 184). Leamson (2002) notes: “What is often called ‘deep learning,’ the kind that demands both understanding and remembering of relationships, causes, effects and implications for new or different situations simply *cannot be made easy*. Such learning depends on students actually *restructuring* their brains and that demands effort” (p. 7).

Deep learning leads to a genuine understanding that promotes long-term retention of the learned material and, just as important, the ability to retrieve it and apply it to new problems in unfamiliar concepts (the idea of “transfer,” which is aptly explored in chapter three of Bransford, Brown, and Cocking, 2000). Surface learning, on the other hand, focuses on the uncritical acceptance of knowledge with an emphasis on memorization of unquestioned, unrelated facts. Retention is fleeting and

there is little long-term retention.

In an overview of the international research on deep learning, Rhem (1995) provided insights into the four characteristics of deep learning, which are echoed by McKay and Kember (1997). These characteristics are:

1. A well-structured knowledge base with a focus on concepts, integration of knowledge, and a cumulative experience.
2. An appropriate motivational level, with an emphasis on intrinsic motivation and a sense of “ownership” of the material.
3. Learner activity associated with active, not passive, learning.
4. Interaction with others, including student-teacher interactions and student-student interactions (Rhem, 1995, p. 4; McKay and Kember, 1997, p. 65).

Cooperative learning — structured group work — (Millis, 2002) plays a crucial role in the final two characteristics. Using interactive lectures can help faculty members sequence assignments and activities by getting students into the well-structured knowledge base through motivating out-of-class assignments (homework). To be useful, this homework must be visible through written output, which can take a variety of forms. Thus, asking students to read chapters with no written output cannot guarantee deep learning.

To result in deep learning, however, faculty must carefully sequence activities — either in class or online — to provide the student active learning and interactions as identified in the deep-learning model. Students must DO something with the work prepared outside of class. Designing sequences that enable students to approach the same material in multiple ways also builds on the science of human learning cited above. Homework is thus not an artificial assignment stuffed into a teacher’s briefcase for later grading. It becomes the foundation for a meaningful sequence to further deep learning. The sequence involves all four elements of the deep-learning model outlined by Rhem (1995) and McKay and Kember

(1997). Students delve into the knowledge base through motivating homework and then “process” this material deeply when the homework becomes the basis for in-class or online activities where students are actively engaged and interacting with one another.

### **Why Adopt Deep-Learning Approaches?**

When faculty members are asked about their most important teaching goals, fostering critical thinking usually tops the list. Most faculty care passionately that students develop an “understanding of key concepts; an ability to go beyond the orthodox and expected so that hitherto unmet problems can be tackled with spirit; a facility with typical methods of approaching a problem in the discipline and...an awareness of what learning and understanding in the discipline consist of” (Ramsden, 1992, p. 21). The research on how students learn provides definite reasons why faculty must shift their teaching methods toward student learning and away from a “stand-and-deliver” approach. Weimer (2002) refers to this approach as “learning-centered teaching,” Finkel (2000) as “teaching with your mouth shut.”

Using cooperative groups or even pairs can significantly increase student learning and foster the deep approaches recommended in the literature (Millis, 2002; Millis, 2010). A meta-analysis by Springer, Stanne, and Donovan (1999) provides strong evidence that the use of small groups can result in greater academic achievement, more favorable attitudes, and increased persistence. Pascarella and Terenzini (2005) determined that cooperative learning and small-group learning improved overall student learning by a .51 standard deviation, evidence that should convince even the staunchest “lecture-holics.”

The biological basis of learning also emphasizes the need for student engagement. Zull (2002) identifies the art of teaching as “creating conditions that lead to change in a learner’s brain” (p. 5), and Leamson (1999) defines learning as “stabilizing, through repeated use, certain appropriate and desirable synapses in the brain” (p. 5). Faculty must teach intentionally — even in large classes where student engagement is more challenging — to involve students in the learning process. They must teach for deep learning, realizing that no one can “go deep” in all areas of content. It is important, therefore, to identify what Wiggins and McTighe (2005) call “enduring understanding,” those key aspects of a discipline that students MUST learn in order to succeed in the next course or, more importantly, in the profession or as citizens. Deep learning — not surface learning — is thus essential for mastering key concepts and skills in virtually all disciplines.

### **What Does Deep Learning Look Like? Three Examples**

#### **Jigsaw Using a Graphic Organizer**

Graphic organizers — visual depictions that suggest

relationships — can help structure homework assignments. A “cooperative jigsaw” using a graphic organizer for the homework can promote deep learning. The example that follows is from a literature class, but teachers can adapt different graphic organizers to focus the homework for virtually any discipline. The in-class active learning and student interactions are based on the cooperative learning approach called “jigsaw” (Aronson et al., 1978). Students form heterogeneous teams of four where each student focuses on a character in a work of literature (well-known examples might be the characters in *Charlotte’s Web*, *Antigone*, *Hamlet*, or *Death of a Salesman*). As homework, each student is responsible for close textual reading that determines not only the four major traits for their assigned character (in the Figure 1 example, Willy, Charley, Happy, or Biff), but also the textual evidence, including quotes or episodes that support those conclusions. They use a graphic organizer such as the sample focused on Willy Lowman (see Figure 1, next page).

In class, students form expert teams composed of all the students focused on the same character. In large classes, teachers can form multiple expert groups by carefully structuring this break-out activity. They could tape signs to the wall of an auditorium, for example, indicating group placements: Willy, Teams 1-6; Willy, Teams 7-12; and so forth. In the expert groups, the students share their findings and then determine not only the most viable of the four traits, but also the best textual evidence to support those conclusions. Those familiar with the original Bloom’s taxonomy (1956) will recognize that these students are evaluating and synthesizing the material, Bloom’s highest levels of thinking. During the final sequence in class, the students return to their original teams and teach their fellow students in their heterogeneous team the in-depth conclusions of their expert groups.

Jigsaw lends itself to virtually any discipline with complex problems that can be subdivided. Some examples might be: (a) psychology or child development: the underpinnings of childhood moral development; (b) botany: major plant groups; (c) history: segments of the Civil War; (d) anthropology: various branches of the discipline; (e) accounting: four methods of depreciation; (f) chemistry: organic molecules that are polymers of carbon; (g) engineering: designing a solar domestic hot-water system; (h) pharmacy: medication for seasonal allergies or common drugs from different classes used to treat diabetes.

#### **Cooperative Debates**

Cooperative debates provide another example of sequencing assignments to build for deep learning. In an English literature class studying *Antigone*, for example, students form teams of four to five students to examine two key questions relevant to the play: “Pro/Con: Should Antigone have buried her brother?” and “Pro/Con: Should Creon be impeached for poor leadership?”

Students draw slips of paper to determine their particular

**Figure 1** • Character-Trait Graphic Organizer (partially completed sample).

<b>Name of Student:</b> Barbara J. Millis <b>Character:</b> Willy Loman, <i>Death of a Salesman</i> by Arthur Miller			
Trait One: Worried, worn out, partially senile	Trait Two: Irritable	Trait Three: Delusional/Boastful	Trait Four: Well-meaning, but inept husband and father
Willy: "I am tired to the death." (Act 1, line 8)  Willy: "I could have sworn I was driving that Chevy today." (Act 1, line 25)  Happy: "He talks to himself." (Act 1, line 122)  Willy: "But they do laugh at me." (Act 1, line 327)  Willy: "I'm getting awfully tired, Ben." (Act 1, line 436)	Willy fusses over the cheese, too many people, etc. (Act 1)  Rants about Biff and says, "Biff is a lazy bum." (Act 1, line 50)  Is disrespectful and short with Charley:  1) "A man who can't handle tools is not a man. You're disgusting." (Act 1, line 434)  2) Calls him an "ignoramus!" (Act 1, line 481)	Willy: "If old man Wagner was alive I'd a been in charge of New York now." (Act 1, line 28)  Willy: "Someday I'll have my own business, and I'll never have to leave home any more." (Act 1, line 230)  Willy: "They know me up and down New England." (Act 1, line 242)	Cheats on Linda, although he loves her. Excuses it with "Cause I get so lonely..." (Act 1, line 335)  Instills the wrong dreams and values in Biff and Happy: It's OK for Biff to steal a football; Bernard can give him correct answers, etc. Tells the boys that the secret to success is not study or hard work: "Be liked and you will never want." (Act 1, line 272)  Tells Ben that he is bringing up his boys to be "rugged, well-liked, all-around." (Act 1, line 513)

team. This random approach allows students to interact with a variety of classmates and ensures that the highest-achieving students do not self-select each other, thus skewing the debate results.

As homework, students read the play closely and gather support for their team's perspective, a motivating assignment getting students into the content. Students receive class time to compare their notes and work on preparing the best possible arguments (active learning/interactions).

To avoid domination by the strongest students, the teams do not know in advance who their spokesperson will be until immediately before the debate. Thus, the teams are potentially only as strong as their weakest member, a situation that results in peer coaching and genuine learning. The spokespersons have a set amount of time, predicated on the length of the class period, to present their team's case. Each team then has class time to prepare a rebuttal. In the second round, the teams choose their own spokespersons. The students who are observing the debate (the half of the class assigned to the other debate topic) vote to determine which side has made the most convincing arguments. The second pair of teams then follows the same procedure for their debate on the second question.

Almost all disciplines lend themselves to debate topics: (a) computer science: Blackboard or Moodle course management platforms? (b) history: Should the United

States have dropped a second atomic bomb on Nagasaki? (c) biology: To clone or not to clone? (d) economics: Should the United States adopt a flat-rate income tax?

#### **Pro-Con-Caveat Grid**

Faculty can sequence activities to promote deep learning in online courses as well as face-to-face ones. The principles and the pedagogical approaches are exactly the same. Only the delivery logistics change.

For example, through the course management system, a faculty member can organize students into online cooperative learning teams (OCLTs) of four to six students where they can work collaboratively on assignments, and communicate quickly and efficiently.

For an assignment using a pro-con-caveat grid, each student in the course uploads an empty pro-con-caveat grid template. Their instructions are to list the arguments in favor of a certain decision, and against the decision, with caveats placed in a third column (see Figure 2, next page). Students submit this assignment to the instructor for pass/fail credit. This step provides the motivating assignment that gets students into the knowledge base. It also ensures individual accountability and preparation for the later stages of the deep-learning sequence.

As a next step, the members of each OCLT share their pro-con-caveat grids and, working as a team (either synchronously or asynchronously, as they choose), develop a single pro-con-caveat grid that represents the best

**Figure 2** • Pro-Con-Caveat Grid by Barbara J. Millis.

Should parking on campus be pro-rated based on salary levels?		
Pro	Con	Caveats
<p>This system would be much fairer because an administrative assistant and a faculty member parking in the same designated area, such as the parking garages, would not pay the same amount.</p> <p>Often, the people who are carrying the heaviest burdens end up parking the farthest away. This would give people in lower pay grades a better opportunity to afford closer parking.</p>	<p>It would be very complex to administer because each designated parking area would have to have various levels of fees.</p> <p>Parking fees constitute a major source of revenue for the university, so efforts to reduce overall costs could negatively impact the budget.</p>	<p>A feasibility study would be needed.</p> <p>The university would need to be able to prevent people from giving their parking passes to others.</p> <p>Some faculty and administrators would resist any changes that might increase their parking fees.</p>

thinking of all their team members. Instructors should indicate deadlines and require assurances that all team members have contributed. Features in many course management systems, much like wiki options, allow instructors to review the contributions of individuals.

This composite grid is then shared with another OCLT team. The OCLTs review the grid they receive and, again, working as a team (with built-in accountability ensuring that all team members contribute), prepare feedback to send the originating team — commenting on features they agreed/ disagreed with, or found surprising, new, or creative. These two steps provide the active-learning/student-student interactions crucial to the deep-learning model.

Because most online teachers find that students need incentives to contribute — usually tied to grades — the instructor will need to award pass/fail points or some other extrinsic reward to the team members for the grid they complete and the grid they comment on. The KISS principle (“keep it simple, stupid”) should be operative, or instructors will find themselves buried in a morass of rubrics, grading pressures, or “whiners” seeking more points.

As a culminating, optional part of the sequence, instructors can review all the team-created grids and post the top three, rank-ordered, possibly awarding extra points to those team members. This step increases the repetition needed for learning and provides useful feedback on the quality of the pro-con-caveat grids.

Figure 2 shows a sample pro-con-caveat grid with a campus-related issue that should be motivating to students and could be relevant for a number of disciplines, including economics, sociology, and English.

Pro-con-caveat grids could include decisions in many disciplines: (a) literature: Nora in Ibsen’s *A Doll’s House* should have left her husband; (b) health sciences/nursing: Based on a case study, a woman should be advised

to withdraw from hormone replacement therapy; (c) economics: Ask students to explore the pros, cons, and caveats of building a hospital in a certain neighborhood in their city; (d) accounting: After reading a case study of a two-career couple, have students list the pros (benefits) of their filing a joint income tax return, and the cons (costs), plus any caveats they should take into consideration.

## Conclusion

Teaching for deep learning requires teachers to identify the most important elements in their course, and to design and develop sequenced activities that will enable students to grapple deeply with these key concepts or skills outside of class. The concepts are further reinforced with in-class or online activities involving active learning and student-student interactions.

Assignments and activities for deep learning can be structured in numerous ways within disciplines, provided that the four critical elements of deep learning, cited by Rhem (1995) and McKay and Kember (1997), are present. As such, faculty interested in deep learning should ask themselves these questions:

1. Does my homework assignment challenge students to grapple with key course material (the knowledge base) with a focus on concepts, integration of knowledge, and a cumulative experience?
2. Is there a written product turned in by each student to provide evidence of this engagement and to allow students to build on their individual learning?
3. Is the homework assignment sufficiently motivating, with an emphasis on intrinsic motivation and a sense of “ownership” of the material, often brought on by choice?
4. Have I designed a motivating reward system that builds in individual accountability but encourages cooperation?
5. Do I use class time or structure online experiences to get students actively involved with the material?
6. Does this active involvement include interactions with others, such as student-teacher interactions and student-student interactions?

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