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Active Learning Strategies in Face-to-Face Courses

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Abstract

As numerous research studies suggest, teachers who desire increased student learning should adopt active learning. This article explores the research, defines active learning, discusses its value, offers suggestions for implementing it, and provides six concrete examples of active learning approaches: Thinking-Aloud Pair Problem-Solving; Three-Step Interview; Think-Pair-Share; Visible Quiz; Value Line; and Send/Pass-a-Problem.

Lecturing, a time-tested and long-venerated teaching method, remains the most frequent method of instruction in higher education throughout the world (Svinicki & McKeachie, 2011; Lambert, 2012, p. 25). It can prove masterful when offered by inspiring teachers who are also gifted orators. But too often students sit passively, disconnected from the lecture, as they actively engage in "facebooking," text messaging, or doing homework for other classes. Lecturing persists, nonetheless, because it provides a convenient and efficient way to deliver content to large numbers of students, particularly in large lecture halls.

Lecturing has advantages. It (1) enables the instructor to supplement the textbook by providing cutting-edge material; (2) gives the instructor presumed "control" in the classroom, although ironically students may not actually be disrupting the flow of material because they are passive or otherwise distracted; (3) lets the instructor offer key information that all students are (presumably) exposed to at the same time; and (4) offers an opportunity for an inspiring teacher to stimulate students.

Despite these perceived advantages, a vast number of studies in recent years—particularly in the area of cognitive science, psychology, and neuroscience—provide evidence that the intuitive conclusions of early educators such as John Dewey and many others were clearly on target: Active learning is a crucial element of the new thrust toward what is now commonly called "learner-centered" or "learning-centered" teaching (Weimer, 2002). If teachers desire increased student learning, then active learning is an essential component of effective teaching. As Hestenes (2012) in an NPR interview put it: "Students have to be active in developing their knowledge."

What is Active Learning?

Most definitions of active learning focus on two key components: "doing" and "reflecting." The most commonly cited definition of active learning comes from Bonwell and Eison (1991): "Involving students in doing things and thinking about what they are doing." The authors emphasize that students must engage in activities that involve reading, writing, discussing, or problem solving.

With their definition of active learning, Bonwell and Eison (1991) anticipated some of the new research on neuroscience that Leamnson (1999) and others are exploring. Leamnson (1999) defines learning as "stabilizing, through repeated use,
certain appropriate and desirable synapses in the brain" (p. 5). Thus, the students' synapses must be active, not just those of the faculty member. There must be a definite shift to learner-centered teaching. Zull (2011) defines education as "lifelong learning built on experience" (p. 14). Like Bonwell and Eison (1991), Zull emphasizes "doing," but he uses the term "action," stating that its value lies in "what the learner perceives about his or her own actions. Action is a test of learning . . ." (p. 30). Zull uses the term "metacognition" to underscore the need for students to think about what they are doing. Metacognition lies at the heart of all learning: "the ultimate outcome of the journey [from brain toward mind] is to understand our own understanding" (Zull, 2011, p. 15). Similarly, Ambrose, Bridges, DiPietro, Lovett, and Norman (2010) define learning in terms of action and experience:

"Learning [is] a *process* that leads to *change*, which occurs as a result of *experience* and increases the potential for improved performance and future learning (p. 3)." Prince (2004) further points out that:

> In practice, active learning refers to activities that are introduced into the classroom. The core elements of active learning are student activity and engagement in the learning process. Active learning is often contrasted to the traditional lecture where students passively receive information from the instructor (p. 1).

Berry (2008) further postulates that four key elements characterize all active learning approaches: (1) critical thinking, (2) individual responsibility for learning, (3) involvement in open-ended activities, and (4) organization of learning activities by the professor. To amplify each of these components, critical thinking can be promoted through higher-order thinking tasks predicated on Bloom's (1956) well-known taxonomy: analysis, synthesis, and evaluation. Brookfield (1987) also emphasizes that critical thinking occurs when students find their assumptions challenged and see alternative ways of approaching problems. These two elements can be fostered through the judicious use of structured group work. As indicated in IDEA Paper No. 38 (Millis, 2002), all four of these key characteristics occur when instructors use cooperative learning. Unlike less structured forms of collaborative learning, cooperative learning requires students to be individually responsible for their own learning. There are no group grades without individual accountability. Any group projects involve peer assessments, self-assessments, and often whole-group assessments to determine individual contributions. Further, group work involves students in open-ended activities that focus on problem solving. Lastly, because cooperative learning is highly structured, the learning activities must be carefully designed and monitored by the professor. As Smith, Sheppard, Johnson, and Johnson (2005) indicate, "engaging students in learning is principally the responsibility of the teacher, who becomes less an imparter of knowledge and more a designer and facilitator of learning experiences and opportunities" (p. 2). Adopting these approaches has enormous pay offs in terms of student learning.

The Value of Active Learning

A meta-analysis of small group learning in the sciences (Science, Technology, Engineering and Mathematics, [STEM]) by Springer, Stanne, and Donovan (1997) included only studies screened for specific criteria and academic rigor. The meta-analysis found that various forms of small-group learning are effective in promoting greater academic achievement, more favorable attitudes toward learning, and increased persistence through STEM courses and programs. A later version of this research reporting the same conclusions appeared in the prestigious *Review of Educational Research* (Springer, Stanne, & Donovan, 1999).

In a study comparing traditional lecture-based classes with those taught using active learning/cooperative learning, Hake (1998, 2002) assembled an impressive data set to assess the effectiveness of alternatives-to-lecture strategies. His study is widely cited, but perhaps the most comprehensive—and clear—explanation for laypersons appears in Nelson (2010). Nelson summarizes Hake's findings by noting that students taught through active group-work methods learned two to three times more than students taught through traditional lecture methods (pp. 122-123).

Prince (2004) also discusses the research evidence for the effectiveness of active learning: "In summary, considerable support exists for the core elements of active learning. Introducing activity into lectures can significantly improve recall of information" (p. 5). These findings are also supported by a summary of active learning in physiology courses provided by Michael (2006): "There IS evidence that active learning, student-centered approaches to teaching physiology work, and they work better than more passive approaches" (p. 165).

Evidence that active learning is being taken seriously by institutions lies in some key architectural renovations that replace tiered auditorium-style seating with round workstations where students can interact. The University of Minnesota Active Learning Classrooms (ALCs), for example, feature round worktables seating nine students, enabling them to collaboratively coach one another either directly or through technology. These classrooms are modeled after the "SCALE-UP" (Student Centered Activities for Large Enrollment Undergraduate Program) concept, developed at North Carolina State University, and the TEAL (Technology Enhanced Active Learning) concept, which originated at MIT (retrieved on May 27, 2012, from http://www.classroom.umn.edu/projects/ALCOverview.html). Significantly, Cullin, Harris, and Hill (2012) devote an entire chapter to "Learning Spaces that Support Learner-Centered Curriculum."

Recent research has returned attention to the maxim that the person doing the teaching is far less important than how students are taught and what they are expected to do. In fact, the opening chapter of a new book on learner-centered teaching focuses on getting students to do the work, a recurrent theme (Doyle, 2011). Carl Weiman, a Nobel-winning physicist, found that in nearly identical classes, students learned more from graduate teaching assistants he had trained to use interactive teaching methods (i.e., small group discussion, in-class quizzes using personal response systems or "clickers," demonstrations, and question-answer sessions) than they learned from a tenured, highly-esteemed professor using a lecture-only approach (Haak, HilleRisLambers, Pitre, & Freeman, 2011).

As multiple studies have indicated, increases in student achievement are only one of the positive results of active learning. Braxton, Milem, and Sullivan (2000) focused

their research on a review of Vincent Tinto's work on retention. Using the Bonwell and Eison definition, Braxton et al. examined the impact of active learning classroom approaches, specifically "class discussions, knowledge-level examination questions, group work, and higher-order thinking activities," on student persistence and their feelings of social integration (p. 571). Their results suggest that active learning may influence students' social integration, commitment to the institution, and their decision whether to remain in school. Given such value in active learning approaches, faculty should know how to introduce them effectively.

Laying the Groundwork for Active Learning

Before introducing active learning approaches, it is a good idea for teachers to clarify their expectations and to emphasize that the active learning approaches used in class will be reflected in the tests, exams, and assignments (Cameron, 1999, pp. 27-28). The optimum place to do this is the course syllabus, but the value of active learning approaches must be constantly reinforced. Sadly, some students resist learner-centered teaching approaches. Doyle (2008) explores eight reasons why they might do so and offers ways to counter these negative responses, including the suggestion that Felder (2011) and others recommend: Explain to students that their active participation will not only increase their learning, but it will also reinforce useful job skills and lead to higher grades. Yorges (2008) makes the point that clarifying learning objectives and course expectations and requirements up front can positively affect student motivation. Faculty members might also "debrief" active learning activities or have students discuss their value.

Lang (2007) also recommends that both faculty and students understand the reasons for major course decisions. He concludes: "The most effective teaching is transparent teaching" (p. C2). Elaborating on this idea, Zahorski (1990) uses an interesting metaphor to define transparency. He urges faculty to step away from the "Oz screen" and to "demystify the teaching-learning process" by sharing their teaching-learning philosophies in the course syllabus and by making students part of the learning process by "turning students into teachers" who understand the nature and value of teaching methods. Transparent teaching means that faculty will explain their methods and motives for specific assignments and activities. For example, in a course relying heavily on Chickering and Gamson's *The Seven Principles for Good Practice in Undergraduate Education* (1987), the faculty member could share with students the original *Wingspread Journal*.

If students are to feel comfortable actively participating, then the classroom climate—the classes' academic, social, emotional, and physical environments—must also be taken into account. Ambrose et al. (2010) recommend several approaches for faculty: making uncertainty comfortable for students; encouraging multiple answers; questioning their own assumptions; being careful not to inadvertently suggest low-student ability, even with positive intents (e.g., "I know you may bring weak academic preparation, so I'll give you some hints"); refraining from asking individuals to speak for a minority; modeling inclusiveness by their words, actions, and attitudes; using many different examples and analogies; building a positive course climate early in the course; establishing ways for students to offer feedback on classroom climate issues; preparing ahead of time to skillfully defuse sensitive issues; attending to any climate issues as soon as they sense them and turning them into learning opportunities; and always listening to students to determine their intended meanings (pp. 180-186).

Some Active Learning Approaches

Active learning can involve individual students in doing things and reflecting on what they have done, or it can involve students working cooperatively in pairs or groups. Some examples of individual approaches include minute papers (indicating the most important thing learned and a point that remains unclear); direct paraphrasing (putting a definition in their own words for a specific audience); application cards (providing a specific real-world application); and lecture summaries (writing down the key points of material covered earlier). Faculty interested in group-based active learning approaches should consult other IDEA papers on this topic by Millis (2002, 2010). Active learning approaches can include the following.

(1) Thinking-Aloud Pair Problem Solving (TAPPS)

To solve case studies, complex problems, or interpret text, students can pair, with one individual designated as the explainer and the other as the questioner. The explainers outline the issues at hand and then begin detailed descriptions of how they would solve the case, problem, or interpretation. The questioners listen, for the most part, but they can also pose questions or offer helpful hints. At a given point, the students reverse roles, a process that continues until the exercise concludes (Felder & Brent, 2009, p. 3).

(2) Three-Step Interview

Common as an ice breaker or a team-building exercise, this structure, developed by Kagan (1989), also helps students reinforce and internalize important concept-related information based on lectures or textbook material. The instructor usually poses the interview questions, focused on content material and having no right or wrong solutions. In a Three-Step Interview, one student interviews another within specified time limits (Step 1). The two then reverse roles and conduct the interview again (Step 2). Two pairs combine to form a foursome, and the students introduce to the rest of the group the ideas posed by their partners (Step 3). An extra question can be added for pairs working more rapidly than others, an "extension" or "sponge" activity recommended to reduce off-task behaviors and to allow fast-moving pairs or groups to tackle more challenging problems.

(3) Think-Pair-Share

In this activity, developed by Frank Lyman (1981), the instructor poses a question, preferably one demanding analysis, evaluation, or synthesis, and gives students 30 seconds or more to think through an appropriate response

(Think). The thinking time can also be spent writing the response. After this "wait time," students then turn to partners and share their responses, thus allowing time for both rehearsal and immediate feedback on their ideas (Pair). During the third and last stage, student responses can be shared within learning teams, within larger groups, or within the entire class during a follow-up discussion (Share). Think-Pair-Share, like most other cooperative learning structures, capitalizes on the principle of simultaneity (Kagan, 1992, p. 4:5-7). Many students (50 percent in Think-Pair-Share) are actively vocalizing ideas at the same time as opposed to a more traditional classroom where the only active individuals are the lecturer or the one student who is responding to the instructor's question.

(4) Visible Quiz (Staley, 2003)

Students in groups discuss the appropriate response to quiz questions, typically multiple choice (A, B, C, or D) or True (T) False (F). Each team has a set of large cards imprinted with one of the four letters or the T or F. The cards also have a unique color (e.g., all A's might be orange and all T's blue). At a given signal, one person from each team displays the team's answer, allowing the instructor to determine how well students understood the question. She then gives the correct answer, going into a mini-lecture if a sizable number of students gave inappropriate responses. She can also call on groups to explain the rationale for their selection, sometimes uncovering misconceptions or poorly constructed, ambiguous wording in the questions. Visible Quiz cards are sometimes called the "poor teacher's clickers" because they function like personal response systems without the histograms and recordkeeping. They have the advantage, however, of allowing teachers to identify immediately the groups giving incorrect answers. As Lasry (2008) points out, the learning depends on the peer coaching, not the delivery mode. The immediate feedback also helps learning.

(5) Value Line

A Value Line ascertains students' opinions in a quick and visual way by asking them to line up according to how strongly they agree or disagree with a statement or proposition. For example, instructors may ask students to respond to the following statements:

- Active engagement will typically lead to greater learning.
- Congress should just print the money to fix our economy.
- Students should take responsibility for the prevention of cheating.
- The United States made the correct decision when invading Iraq.
- The Patient Protection and Affordable Care Act will strengthen the U. S. healthcare system.

Clear instructions reinforced by visual aids are particularly important for implementation of a Value Line because many students are unaccustomed to active learning that involves active movement. Interestingly, Medina (2008) and others emphasize that human brains evolved when our ancestors were constantly on the move and, thus, movement enhances learning. To initiate the structure, teachers ask students, after a moment of "think time," to jot down a number from 1 to 5 that best describes their position on a given issue. Instructors next ask students who have chosen "1" to stand at a designated point along the wall of the room. The students who have chosen "2" follow them, and so forth until all students are lined up. After the students have formed a continuous line based on their own opinions, instructors identify the midpoint. The easiest way to do this is to ask students to number themselves sequentially in a count-off (1, 2, 3, 4, 5, etc.).

The teachers can then form heterogeneous discussion groups by taking one student from each extreme of the line and two from its midpoint. Instructors continue to form teams with this procedure until all students have been assigned to a team and have found their designated seats. Any students left over join a team as a fifth member.

(6) Send/Pass-a-Problem

This structure is particularly effective for problem solving. Its exact source is unknown. The Howard County Maryland Staff Development Center developed a version of it inspired by Kagan's (1989) work. The starting point is a list of problems, issues, or case studies, which can be generated by students or can be teacher-selected. Each team records its problem on the front of a folder or envelope. The teams then brainstorm effective solutions or responses for these problems, issues, or case studies, recording them on a piece of paper. At a predetermined time, the ideas are placed in the folder or envelope and forwarded to another team. The members of the second team, without looking at the ideas already generated, compile their own list of solutions or responses. The folder with the two sets of ideas is forwarded to a third team which now looks at the suggestions provided from the other teams, adds its own, and then synthesizes the ideas from all three teams. Alternatively, if the problems generated a list of ideas, then the teams can select the best two solutions. During this activity, students are engaged in the highest levels of Bloom's taxonomy (1956)—evaluation and synthesis.

Many other active learning approaches are available, such as academic games, analysis of or reactions to videos, student debates, case study discussions, concept mapping, and many more (see web resources on active learning from the University of Medicine and Dentistry: http://cte.umdnj.edu/active_learning/active_general.cfm, retrieved May 27, 2012). Best of all, these approaches can be used in classes of any size from the freshman level to graduate school. Tools such as personal response systems ("clickers") or mobile devices are available for large classes. An interactive suite of tools designed for laptops in large classes has also shown promising results (Samson, 2010). Many of the activities used for face-to-face active learning can be adapted to online use through tools such as threaded discussions, blogs, and wikis.

Conclusion

As John Dewey and other advocates have suggested, active learning—because it is grounded solidly in the biological basis of learning and because it has been increasingly researched and reviewed—is not just the latest academic fad. On the contrary, active learning is a well-tested approach that teachers committed to student learning should consider adopting. Intentionality provides the key to using active learning effectively, just as purposeful teaching helps faculty members use cooperative learning and other approaches that lead to deep learning. Carnes (2011) also notes that teamwork and problem solving result in strong pedagogical gains and concludes that students "need to attend classes that set their minds on fire" (p. A72).

Barbara J. Millis, director of The Teaching and Learning Center at The University of Texas at San Antonio, has presented workshops at academic conferences at over 300 colleges and universities, including numerous Lilly Teaching Conferences. She has published numerous articles on such topics as cooperative learning, classroom observations, peer review, academic games, and active learning, and has edited or co-authored four books, most recently The Course Syllabus: A Learning-Centered Approach (Jossey-Bass) and Cooperative Learning in Higher Education: Across the Disciplines, Across the Academy (Stylus). While at the U. S. Air Force Academy, she won awards for both teaching and research.

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