Original article was published in AAHE Bulletin, April 1993, 3-13.

A "TEACHER'S DOZEN"

Fourteen General, Research-Based Principles for Improving Higher Learning in Our Classrooms

by Thomas Anthony Angelo

How much trust would you place in an engineer who admitted to having no knowledge of thermodynamics or other basic principles of physics, and who thought, in fact, that those physical laws didn't apply to his work? How much confidence would you have in a physician with no understanding of how bacteria and viruses cause infection, one who believed that biochemistry was irrelevant to her practice? If by some terrible mistake you were arrested and put on trial, would you hire a lawyer who thought that keeping up with the research on jury selection, effective defense strategies, and sentencing patterns was a waste of time?

These questions are obviously rhetorical, because we all expect -- or at least hope -- that professionals will be knowledgeable and keep current in the research that informs their practice. But, as college teachers, do we expect as much of ourselves?

Unless you're in a field such as cognitive science or educational psychology, chances are slim that your graduate education included any survey of the research on how humans learn. And even within cognitive science and educational psychology doctoral programs, future professors rarely study the research on adolescent and adult learning. As faculty, we tend to assume that knowing a great deal about our specific discipline -- say, British literature, biology, business, or Byzantine church history -- is sufficient preparation for teaching. Unfortunately, as most department chairs and all faculty who have children in college soon learn, that is a faulty assumption. Mastery of one's discipline may be *necessary* for effective college teaching, but it surely isn't *sufficient*

Three Assumptions

Before going any further, let me lay out the three main assumptions that undergird this article. The first is that to most effectively and efficiently promote earning, faculty need to know something about how our students --and indeed how we ourselves -- learn. The second assumption is that there really are some general, research-based principles that faculty can apply to improve teaching and learning in their classrooms. And the third is that college teaching is so complex and varied that faculty members themselves will have to figure out whether and how these general principles apply to their particular disciplines, courses, and students. The discussion that follows rests on these three assumptions like a stool on three legs: If they're sturdy, then what follows will hold up.

While there isn't space here to adequately test these three "legs," a few comments on them might be helpful. First, I assume it's important for faculty to know something about how humans learn because teaching that ignores this knowledge runs the risk of being inefficient, ineffective, and sometimes even counterproductive. The time, energy, and aspirations that we and our students invest in coursework are simply too valuable to spend carelessly.

Second, while few savvy faculty would argue that we know *nothing* useful about learning, many still protest that we don't yet know *enough* to inform teaching practice. It is true that there's still much to discover, but at the same time we do collectively know a great deal about how people learn, far more than we use. Solid research by cognitive scientists, psychologists, ethnographers, and other researchers offer much more direction to College teachers of the 1990s than was available even a decade ago. To argue that we shouldn't use what we know in teaching because our knowledge is incomplete is like arguing that sailors shouldn't use available knowledge about weather and currents in navigation because that knowledge is incomplete. Only by using what we already know can we learn more.

So, what exactly do we know about learning that might be useful to college teachers? My response is the "teacher's dozen" referred to in the title. It's my own list of fourteen principles of effective higher learning that are well supported by research. My "teacher's dozen" isn't meant to be definitive or exhaustive. It's simply one college teacher's current list of solid principles to teach by.

Why fourteen? The best known and most discussed list is Chickering and Gamson's "Seven Principles for Good Practice in Undergraduate Education." Their "Seven Principles" remain the standard, and most of those research-based guidelines can be found in my "teacher's dozen." But in making up my list, I found there were also other, more specific principles I couldn't teach without. Though I tried to limit myself to twelve, the teacher in me just couldn't give up that content. So, in the end, I decided that if a 'baker's dozen" is thirteen, then surely a 'teacher's dozen" could be fourteen.

Three Goals

Of course, whether such a list should include four, fourteen, or forty-four principles is open to discussion and debate. The first goal of this "teacher's dozen" is to encourage just that sort of questioning and dialogue. It's to invite faculty to think, talk and perhaps even read more about the connections between what we know from research on learning and how we practice teaching. Chickering and Gamson's "Seven Principles," or any other general guidelines based on research, will only stimulate meaningful, longlasting changes in teaching behavior if faculty make the principles personally meaningful by connecting them to their everyday teaching fives. On your campus, for example, you might begin this connecting process by compiling a list of principles from learning research that guide your own teaching and then comparing it with lists drawn up by your colleagues. At the least, comparing lists could make for stimulating lunchtime discussion or enliven a department meeting.

A second goal is to encourage faculty to use their personal "teacher's dozen" as criteria for assessing their current teaching practices. Once you know what principles you ascribe to, you can better determine how well your teaching embodies them. You can use a simple checklist of learning principles to quickly review your course syllabi, class notes, assignments, tests. Or you might watch a videotape of yourself teaching, checking your actions against your list. The videotape might reveal that, even though you're convinced active engagement is critical to learning, you're still doing most of the work in class, while your students passively observe.

A third, related goal is to encourage faculty to identify the implications of their "favorite" guiding principles and then develop practical classroom applications. If my third assumption is correct, each combination of teacher, course, and students is so unique that general principles have to be either "custom fit" or "custom built" to be useful in a particular class. The operating axiom is: Adapt, don't adopt. Therefore, the classroom implications and applications of these principles must be generated and validated by individual faculty if they are to have any value. Applying your own "teacher's dozen" might involve making changes in your teaching techniques, homework assignments, or tests. To return to the videotape example, once you've observed that your students

are not actively engaged in class, you can begin to systematically experiment with new techniques and approaches --and assess how much difference they make.

A Working Definition of Higher Learning

The broader agenda behind these three goals is to help faculty improve the quality of higher learning in their classrooms. But what does that mean? As an exercise in *active* reading and learning, I suggest you take out a pencil and a piece of paper now and write a one- or two-sentence definition of *higher learning* before you read any further. Once you've jotted down your draft definition, we can compare not notes to make sure we have similar concepts in mind.

What is higher learning? I define higher learning as an active, interactive process that results in meaningful, long-lasting changes in knowledge, understanding, behavior, dispositions, appreciation, belief, and the like. The key terms in this definition are *meaningful, long-lasting,* and *changes.* Higher learning is *meaningful,* if the learner understands and appreciates what is learned; that means that something learned by rote but not understood would not qualify. By long-lasting, I mean learning that will endure in accessible memory at least beyond the end of the term. And ***changes*** here means not simply the addition of knowledge but also the transformation of ways of understanding and organizing the knowledge learned.

This is a demanding definition of higher learning, and I certainly don't always fulfill it, but having an explicit definition does help me make difficult decisions about what and how to teach. Since there is always more worthy course content than time in the semester, I need criteria for making hard choices about what to leave out. Asking myself whether a given class activity, reading, or homework assignment will contribute
on tribute to meaningful and lasting learning is a helpful decision rule.

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Before I share my current "teacher's dozen," a final caveat is in order. Given the range of human variation, there are bound to be exceptions to nearly every generalization about learning. It's up to individual faculty members to determine which principles apply to whom, when, where, and how.

That said, for each of the fourteen principles listed below, I'll offer a very brief explanation and then suggest one or two implications for or applications to teaching and classroom assessment. These general implications and applications are meant merely as "pump-primers," to stimulate you to come up with more specific, appropriate ones.

1. Active learning is more effective than passive learning.

> *What I hear, I forget; what I see, I remember; what I do, I understand.*
>
> -Chinese proverb

> *Let the main object of this, our Didactic, be* as follows: *To seek and find a method by which teachers may teach less, but learners learn more.*
>
> -John Amos Comenius

As these quotations suggest, teachers have long known what researchers have only recently confirmed about the value of active learning: Students do learn more and better by becoming actively involved. But activity, in and of itself, doesn't result in higher learning. Active learning occurs when students invest physical and mental energies

in activities that help them make what they are learning meaningful, and when they are aware of that meaning-making. As George Stoddard put it, "We learn to do neither by thinking nor by doing; we learn to do by thinking about what we are doing."

Implications/Applications. Having students teach or explain something to others that they have just learned helps them learn it much more effectively, especially if they actively rehearse that "lesson" ahead of time and get feedback. To assess actively, ask students to paraphrase a central concept in a couple of sentences for one specific audience, and then to paraphrase the same explanation for a completely different audience. The two audiences might be parents and children, professionals and laypeople, novices and experts. Assess these directed paraphrases for both accuracy and appropriateness.

2. Learning requires focused attention, and awareness of the importance of what is to be learned.

The true art of memory is the art of attention.
-Samuel Johnson

One of the most difficult tasks for novice learners in a field, whatever their age, is to figure out what to pay attention to and what to ignore. Students in introductory courses often cannot tell what is central from what is peripheral, foreground from background, superordinate from subordinate. Novices find these distinctions elusive, usually not because they lack intelligence but because they lack the experience needed to evaluate the data they encounter. If you've ever found yourself lost and alone in a busy city in a country whose language, culture, and street signs are totally unintelligible (some of you are thinking Boston; others, New York), then you can imagine how many students feel when they encounter a "foreign" discipline for the first time in college.

Implications/Applications. You can help novices by pointing out some of the major landmarks, by writing a list of the five key points in your lecture on the board before class, for example. You also can assess how well they are learning to read the "maps" that lectures or readings provide. Using a "Minute Paper" to find out what students thought were the most important points in a lecture or reading and what questions they still have can provide useful information on where they are getting lost and clues for getting back on track.

3. Learning is more effective and efficient when learners have explicit, reasonable, positive goals, and when their goals fit well with the teacher's goals.

If you don't know where you are going, you will probably end up somewhere else.
-Laurence J. Peter and Raymond Hull

When learners know what their educational goals are and figure out how they can best achieve them, they usually become much more efficient and effective. Adult learners often fit this bill. When learners know how and how well their goals fit the instructor's, they tend to learn more and get better grades.

Implications/Applications. Early in the term, ask students to write down a few specific learning goals they hope to achieve through your course. Then involve them in comparing their learning goals with those of other students, and with your teaching goals. Look for and build on areas of congruence, but don't gloss over potential conflicts or disconnects. Refer back to and assess progress toward shared goals throughout the semester.

4. To be remembered, new information must be meaningfully connected to prior knowledge, and it must first be remembered in order to be learned.

Thinking means connecting things, and stops if they cannot be connected.

-G. K. Chesterton

The more meaningful and appropriate connections students make between what they know and what they are learning, the more permanently they will anchor new information in long-term memory and the easier it will be for them to access that information when it's needed.

ImplicationslApplications. Provide many and varied examples/illustrations, descriptions/drawings, images, metaphors, and analogies. But ask students to provide them, as well, then give the students feedback on their usefulness and appropriateness. For instance, two simple ways to help students make connections, and to assess the connections they are making, are to ask them to compose a metaphor ("Learning is _____") or to complete an analogy ("Teaching is to learning as _____is to_____").

5. Unlearning what is already known is often more difficult than learning new information.

It is what we think we know already that often prevents us from learning.

-Claude Bernard

Habits, preconceptions, and misconceptions can be formidable barriers to new learning, all the more treacherous because, like icebergs, this prior learning is usually 90 percent hidden from view. Before we can help students unlearn or correct prior learning, we need to know something about what is below the surface.

Implications/Applications. Before you present new material, find out what students already believe and know, and what they can do about it. A quick diagnostic "probe," containing a few questions, often can help you locate dangerous "icebergs." By asking a few diagnostic questions, you might also find out that the shipping lanes are clear and that your students are more experienced navigators than you had assumed. Whatever you discover, it will help you and the students find more appropriate starting points for your work.

6. Information organized in personally meaningful ways is more likely to be retained, learned, and used.

Much goes an in the mind of the learner. Students interpret. They overinterpret. They actively struggle to impose meaning and structure upon new material being presented

-Donald A. Norman

Humans are extraordinary pattern seekers. We seek regularity and meaning constantly, and we create them when they are not apparent. Witness our penchant for seeing dragons in clouds, for example. To be most useful, the ways learners organize knowledge in a given domain need to become ever more similar to the ways experts in that field organize knowledge. This requires making what is usually implicit, explicit.

Implications/Applications. Show students a number of different, useful, and acceptable ways to organize the same information. Use prose, outlines, graphs, drawings, and models. Assess students' organizing schemas and skills by getting them to show you their "mental models" in a similar variety of ways.

7. Learners need feedback on their learning, early and often, to learn well; to become independent, they need to learn how to give themselves feedback.

Supposing is good, but finding out is better.

-Mark Twain

Regular feedback helps learners efficiently direct their attention and energies, helps them avoid major errors and dead ends, and keeps them from learning things they later will have to unlearn at great cost. It also can serve as a motivating form of interaction between teacher and learner, and among learners. When students learn to internalize the voice of the "coach," they can begin to give themselves corrective feedback.

Implications/Applications. Don't assume that students understand, ask. Try asking them to jot down what the "muddiest point" was in a particular reading, lab, or lecture, then respond to the most common "muddy points" in your next class. Find out what students are doing with the feedback you're already giving them. Do they read and use the comments you write on papers and exams? If so, how? If not, why not? Explicitly demonstrate how you get feedback on your work and what you do with it.

8. The ways in which learners are assessed and evaluated powerfully affect the ways they study and learn.

> *Let the tutor demand an account not only of the words of his lesson, but of their meaning and substance... Let [the learner] show what he has just learned from a hundred points of view, and adapt it to as many different subjects, to see if he has rightly taken in it and made it his own.*
>
> -Michel de Montaigne

Whether faculty "teach to the test" or not, most students are going to try to "study to the test." For generations uncounted, students have annoyed their teachers with the question, "Will this be on the final?" One reason they persist is that most genuinely want to get good grades. But a second reason is that knowing what will be on the final, or on any upcoming test or quiz, helps students figure out where to focus their attention. In other words, they are looking for a roadmap. One way to improve learning, then, is to make sure our test questions require the kind of thinking and learning we wish to promote, and that students know - at least generally - what those questions will be.

Implications/Applications. Once you're sure your questions are testing what you want students to learn, give them a sample exam or a list of study questions from which the exam questions will be selected. Give students regular opportunities to practice answering similar questions and to get feedback on their answers. If students work in study groups, that corrective feedback often can come from their peers.

9. Mastering a skill or body of knowledge takes great amounts of time and effort.

> *There are some things that cannot be learned quickly, and time, which is all we have, must be paid heavily for their acquiring.*
>
> -Ernest Hemingway

In a study of talented young adults who had achieved high levels of mastery in a variety of fields, Benjamin Bloom and his colleagues found that none had achieved mastery in less than a dozen years, and the average time to mastery was sixteen years --at between 25 and 50 hours per week of practice and study. This means that at least 15,000 to 30,000 hours of time and intense practice were required to reach the highest levels of mastery. If we halve those figures to "guesstimate" the time needed to achieve an *acceptable* mastery level, we're still left

with about 7,000 to 15,000 hours of preparation -- the equivalent of 40 hour weeks, fifty weeks a year, for three-and-a-half to seven years.

Implications/Applications. Unplug all the TVs! Seriously, though, students need to know how long it actually takes to attain mastery in their field. Then they need to find out how much time they actually are devoting to that task. Give students a simple form on which they can log all the times they study/practice for a week and indicate how productively they used each block of time. Discussing their findings with other students in a nonjudgmental way can help them become aware of and gain control over their time use.

10. Learning to transfer, to apply previous knowledge and skills to new contexts, requires a great deal of practice.

Research on learning to transfer generally is depressing. Most *learning is* highly context-bound, and few students become skilled at applying what they've learned in one context to another similar a context. In fact, many students cannot recognize things they've already learned if the context is shifted at all. This is one of the reasons why students will point at questions that are only slightly altered versions of homework questions and protest, "We've never done problems like these before!" Those students who are being honest simply cannot see the similarities. They learned to solve problems involving giraffes, motorcycles, and Cincinnati; they never had to solve problems about wildebeest, cars, or Dayton.

I*mplications/Applications.* If you value transfer, teach transfer. Direct students' attention continually between the general and the specific. Give them many different examples of the same concepts or principles, and make sure they see where the similarities and the differences are. Challenge students to identify and then to create similar but different examples or problems.

11. High expectations encourage high achievement.

For some time now, we've known that younger students tend to achieve more by working with teachers who expect more of them. For the so-called "Pygmalion effect" to work well in college, however, the students must share the teacher's high expectations of themselves and perceive them as reasonable.

Implications/Applications. Begin by finding out what your students expect of themselves in your class, letting them know what you expect, and discussing those expectations. Begin the course with assignments that diligent students can succeed in to build confidence. Have learners interview successful former students, or invite them to class, to illustrate in flesh and blood that high expectations can be realized.

12. To be most effective, teachers need to balance levels of intellectual challenge and instructional support.

In discussing the ways in which mothers help children acquire language by constantly adjusting their speech to stay slightly ahead of the child's, Jerome Bruner writes of "scaffolding." Scaffolding is a useful metaphor for college learning, as well. The weaker or smaller the student's foundation (preparation) in the subject, the stronger and larger the instructional scaffolding (structure and support) that is required. This is one of the many reasons that teaching a first-year course requires a different approach than teaching a third-year course in the same discipline. Students in the third year generally require less structure and direction, and benefit from more autonomy and responsibility. This also helps explain why students of lower ability or much weaker preparation often benefit from and appreciate highly structured courses. They need the scaffolding.

Implications/Applications. Even when learner ability or preparation or both are weak, expectations should remain high. To reach those expectations, less prepared students will need more and more explicit instructional "scaffolding" such as tutoring, highly structured directions, and more personal contact with the instructor. Students who are better prepared or more able can be encouraged to master their learning by serving as tutors, helping to create scaffolding for others, and to take more responsibility for their own learning through independent studies and special projects.

13. Motivation to learn is alterable; it can be positively or negatively affected by the task, the environment, the teacher, and the learner.

Though we tend to talk about students as being either "motivated" or "not motivated," most of our students are very motivated to learn certain things and not at all motivated to learn others. Research suggests that you stand a good chance of increasing motivation to learn if you can positively influence your students' beliefs and expectations about one or more of the following: Students are likely to be more motivated to learn in your class if they see the value of what you're teaching; believe that learning it will help them achieve other important goals; believe that they are capable of learning it; and expect that they will succeed.

Implications/Applications. Give students lots of specific examples of the value and usefulness of what they're learning and help them make connections between short-term course goals and their own long-term goals. Use simple, anonymous surveys to gauge students' expectations, beliefs, and self-confidence levels, then respond to that information with specific examples, suggestions, and, whenever possible, realistic encouragement.

14. Interaction between teachers and learners is one of the most powerful factors in promoting learning; interaction among learners is another.

As with activity, it isn't interaction in and of itself that promotes academic learning, it's structured interaction focused on achieving meaningful, shared learning tasks. As the professional world never tires of pointing out, our students need to learn to work more effectively in teams.

Implications/Applications. Most students have to believe teachers know and care about them before they can benefit from interactions - or even interact. Learn students' names as a first step, then try to engage them in working with you to learn. Classroom Assessment and Classroom Research projects can engage students and teachers in working together to solve meaningful problems, such as finding ways to ensure that *everyone* in class has a fair chance to master the course content. If you want students to cooperate effectively with other students, first, challenge them with assignments that groups can carry out more effectively than individuals can; second, provide guidelines and guidance for group work especially for those who haven't had experience; and, third, de-emphasize competition among individuals for grades and approval. Meaningful and positive interactions require mutual trust.

Final Notes

Nothing is so useless as a general maxim.
-Lord Macaulay

Psychology is a science, teaching is an art, and sciences never generate arts directly out of them selves. An intermediary, inventive mind must make the application, by use of its originality.
-William James

I argued at the outset that mastery of an academic discipline is not sufficient for effective college teaching. But even disciplinary mastery complemented by familiarity with research on college learning is not sufficient. Truly effective teachers know their subjects, know something about the research that informs teaching, and also know how to adapt and apply relevant research findings to their own classrooms. Lord Macaulay was partially correct: Nothing is so useless as a general maxim that isn't properly applied to the particular. With James, I'm convinced that we **need** inventive, original minds to make the applications of these or any other general principles of teaching. I'm also confident we have such "intermediary, inventive" teachers in abundance among our faculty.

Note: This article was adapted from Session 56: "A Teacher's Dozen": Fourteen (General) Findings From Research That Can Inform Classroom Teaching and Assessment and Improve Learning," from AAHE's 1993 National Conference on Higher Education.

Resources
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