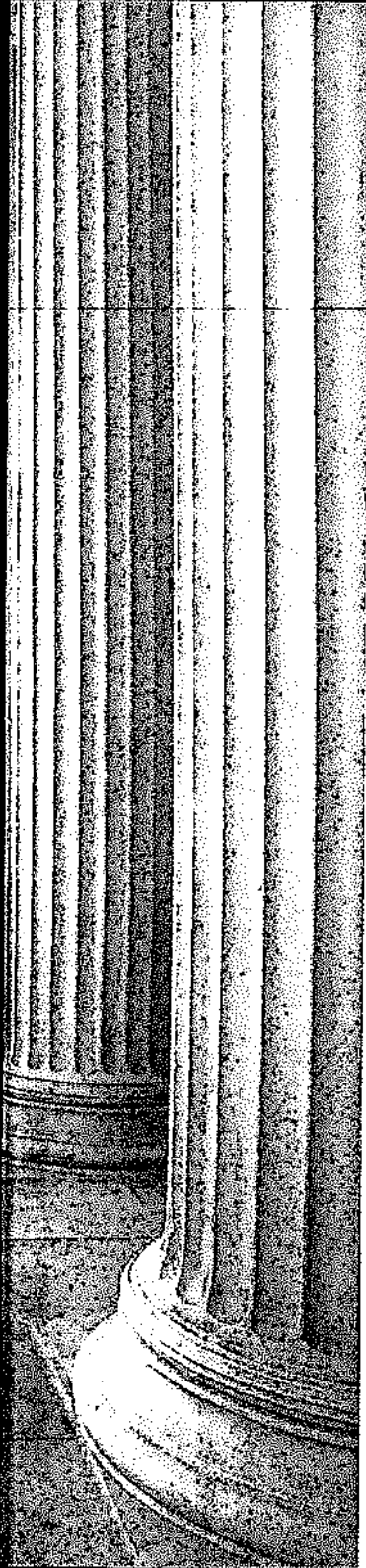


POD

Professional and Organizational Development  
Network in Higher Education

VOLUME 28



Resources for Faculty,  
Instructional, and  
Organizational  
Development

EDITOR

ASSOCIATE EDITOR

## DYSFUNCTIONAL ILLUSIONS OF RIGOR

LESSONS FROM THE SCHOLARSHIP OF  
TEACHING AND LEARNING

---

*Craig E. Nelson, Indiana University*

*My initial teaching practices were based on nine "dysfunctional illusions of rigor." Overcoming them required revision of my ideas on the value of "hard" courses, the effectiveness of traditional methods, grade inflation, what students should be able to do initially, the fairness of traditional approaches, the importance of fixed deadlines, the importance of content coverage, the accessibility of critical thinking, and the appropriate bases for revising courses and curricula. I present the initial illusions and some more realistic views. These more realistic views are framed in terms of key research findings and some readily accessible models for improved practices.*

*The important point that should not be lost is that all professionals—including . . . faculty members and students affairs staff—are loaded down with assumptions, expectations, customs, routines, and personal preferences that make it difficult to see and do things differently.*

—George Kuh

---

I could have not made the journey encapsulated here without major help, much of which came from faculty developers. From IU, I especially thank Tom Schwen, Samuel Thompson, and Jennifer Robinson. So many others from other institutions have given me help at various meetings that I am unable thank them individually. Hence I dedicate this chapter to all faculty developers. I hope that you find it useful.

After I became a faculty member, I slowly realized that much of my teaching was less successful than I had hoped. I began attending teaching workshops, searching for changes that would increase students' success without lowering academic expectations. My progress was impeded by a series of misconceptions about teaching and learning that I used at least implicitly to justify my existing approaches. I now think of these misconceptions as "dysfunctional illusions of rigor." Such illusions may support traditional teaching even after faculty understand more effective practices and the data that support their use.

### Can We Reduce or Eliminate Fs—Even in Tough Classes?

Let us begin by confronting three basic illusions of rigor that are commonly held in the academy.

#### *Some Key Findings*

Treisman (1992; Fullilove & Treisman, 1990) found that about 60 percent of the African Americans enrolled in calculus at the University of California at Berkeley made a D or F or withdrew. He surveyed faculty from multiple departments for solutions. They overwhelmingly suggested that something was wrong with the African American students: ability, preparation, social shock, employed excessively, and so on. Treisman showed that these hypotheses were largely not applicable. Most spectacularly, the African Americans with the *highest* math entry scores were the most likely to do poorly. The groups of students who were doing best spontaneously formed study groups, consulted with older peers, and obtained old exams and homework from older friends. Students who were not doing as well tended to do as the instructor suggested—study two hours out of class for every hour in class—but did it by themselves with little social support. Treisman invited the African Americans into *honors* homework sections and required that they do group work. They attended the regular large lectures sections and took the regular exams. The D, F, or W rate went from 60 percent to 4 percent. There were no deficits that were not made irrelevant by appropriate pedagogy.

Hake's meta-analysis for introductory physics (1998) also changed my thinking. Standardized pretests and posttests of conceptual understanding had been used in a variety of introductory courses. For each course, Hake calculated the *average normalized gain*,  $\langle g \rangle$ , as the ratio of the actual average gain in class understanding (posttest mean minus pretest mean) to the maximum possible average gain for that class (100 minus the pretest

mean). 7 percent. tive enga ally taug was com the stanc waste of pedagogy Many ment, an using wri no Fs (Ar and find (Nelson, chemistry 2000). Fr for science that the a from the : a synthesi

#### *Readily /*

The persis alternative ple, Barkl Cooper, R Millis & C has feature Nelson (20

Four ke extensive st tive studen assessment learning, ar

Thus far, pedagogica once held st

*Dysfunci* dents. Whe tion, or lack

mean). Traditional lectures produced an average normalized gain of 23 percent. Various forms of structured student-student interaction ("interactive engagement") produced an average gain of 48 percent. No traditionally taught class came near the mean for interactive engagement. There was comparatively little difference in gain between the worst and best of the standard lecture courses. Effort spent on improving lectures was a waste of time in comparison with that spent on transforming the pedagogy.

Many additional studies have shown similarly large changes in achievement, and often also in equity and retention. To cite three examples: using writing out of class and group work in class to teach calculus with no Fs (Angelo & Cross, 1993), teaching economics with active learning and finding no Fs over three years against several control sections (Nelson, 1996), and reducing low grades with active learning for the chemistry students with the lowest mathematics SAT scores (Jacobs, 2000). Froyd (2007) discussed several additional examples. A meta-analysis for science and related fields (Springer, Stanne, & Donovan, 1999) found that the average effect of small-group learning would move a student from the 50th percentile to the 70th. Handelsman et al. (2004) supplied a synthesis.

### *Readily Available Models for Easy Changes*

The persistence of traditional teaching methods is not due to a lack of alternatives. Several books furnish easily adaptable examples (for example, Barkley, Cross, & Howell Major, 2004; Bonwell & Eison, 1991; Cooper, Robinson, & Ball, 2003; Johnson, Johnson, & Smith, 2006; Millis & Cottell, 1997). The Science Education Resource Center (2009) has featured thirty-five methods, usually with links and other resources. Nelson (2008) listed several important links.

Four key components of many effective interactive pedagogies are extensive structuring of the learning tasks by the teacher, strongly interactive student-student learning, effective immediate debriefing or other assessments that furnish prompt feedback to the teacher on the actual learning, and subsequent instructional modifications.

Thus far, I have summarized several key findings and some alternative pedagogical models. These illuminate three dysfunctional illusions that I once held strongly.

*Dysfunctional illusion of rigor 1.* Hard courses weed out weak students. When students fail it is primarily due to inability, weak preparation, or lack of effort.

This was the way I had viewed my own education. When I did poorly, I blamed my own lack of effort, not flaws in the pedagogy.

*More realistic view.* When students fail it is often due to inappropriate pedagogy. Substantial improvements were produced (see above) even in classes traditionally regarded as *necessarily* difficult, among them calculus, physics, chemistry, and economics. This is not to say that students have no responsibility for their own work. Rather, we have grossly underemphasized the faculty members' responsibilities.

*Dysfunctional illusion of rigor 2.* Traditional methods of instruction offer effective ways of teaching content to undergraduates. Modes that pamper students teach less.

I certainly believed this enthusiastically. Hadn't the lecture method worked for me? Wasn't it the approach embraced by all of my undergraduate science professors and by most of those I had in other fields? Wasn't it the main method used by my colleagues?

*More realistic view.* In a paper that partially foreshadowed this one, "Living with Myths: Undergraduate Education in America," Terenzini and Pascarella (1994) stated, "The evidence we reviewed is clear" that the lecture mode "is not ineffective" (p. 29). Remember that in introductory physics, classes taught with traditional lectures usually learn about 23 percent of what they collectively missed on the pretest (Hake, 1998). Lectures do indeed teach something. Terenzini and Pascarella (1994) continued: "But the evidence is equally clear that these conventional methods are *not* as effective as some other far less frequently used methods" (p. 29). The comparison, still from physics, is that alternative methods teach on average twice as much as traditional lectures (Hake, 1998).

*Dysfunctional illusion of rigor 3.* Massive grade inflation is a corruption of standards. Unusually high average grades are the result of faculty giving unjustified grades.

This follows from the preceding illusions. If low grades were mainly a consequence of students' inadequacies, then massive improvements would be quite unlikely unless standards were lowered. This was a view I advocated well after I began teaching.

*More realistic view.* When Treisman massively improved the achievement of African Americans, he produced substantially improved grades. Similar results are clear in several of the studies cited above. Thus, we need to distinguish between *bad grade inflation* resulting from unjustifiably high grades and *good grade inflation* from more effective pedagogy and consequently improved achievement. We need a lot more of the good kind of grade inflation. It is the faculty member's job to document good grade

inflation. It is the administration's job to reward good grade inflation and punish bad grade inflation.

### Producing Brighter and Harder-Working Students in a Flash

In this section, we examine four more widespread illusions of rigor that are somewhat more "advanced."

#### *Some Key Findings*

In the previous section I focused on studies that have produced numerically powerful results. Equally important and impressive results have come from narrative traditions. Rose (1990) offered stunning examples of the barriers to students from "America's underclass" that result from faculty implicitly or explicitly assuming that the students have already mastered an array of disciplinary conventions before they arrive at college. (I regard Chapters Seven and Eight as essential reading for faculty.) Colomb (1986) found that one of the hardest tasks in learning to write for college (and work) was learning to avoid all of the perfectly reasonable things that one might say or write that are not allowed by the conventions of the discipline.

In biology, remarks on memories evoked by the colors of the chemicals used are out of bounds, as are comments indicating empathy for the lettuce or fruit flies that one is grinding up. Conversely, in humanities it is rarely appropriate to speculate on how different a visual piece would seem if we had, like many birds, four rather than three pairs of contrasted primary color responses. In either case, it may also seem digressive to wonder about any environmental racism involved in the extraction of the minerals that were used to produce the chemicals or pigments—even though exactly such considerations might be central to some courses in other departments.

#### *Models for Change*

Streepey (in Nelson, 1996) taught her classes how to write essay questions. She had them compare various B answers she had written for a question and then construct ideal answers individually and in groups. In one hour, she converted an average English section to a high-achieving one. Similarly, Walvoord and Anderson (1998) had students use rubrics to rate alternative examples prior to using those rubrics in actual writing.

These studies seemed to me to clearly support fundamental changes. But, I still was initially loath to use class time to teach students how to read and write appropriately.

Ultimately, I found that four additional illusions had blocked my progress.

*Dysfunctional illusion of rigor 4.* Students should come to us knowing how to read, write, and do essay and multiple-choice questions.

I was especially appalled when I saw that students did not know how to do multiple-choice questions in my introductory biology course. How, I wondered, could they have possibly have graduated from high school and made it into Indiana University without knowing how to do multiple-choice questions? It took me some time to see that university level exams included a much greater emphasis on conceptual understanding, applications, and synthesis than was likely to have been possible early in high school when students typically take biology. I was similarly incredulous when I saw that about 90 percent of the students in my first-year seminars could not easily answer an essay question that required them to summarize the author's argument. This was true even when they were directed to read the two pages on which the argument occurred while working on the question. It became evident that students were used to saying what the text was about but not used to being able to accurately summarize the arguments made in the book. Clearly, they needed to learn to summarize the arguments before they were going to be able to learn to evaluate them.

*More realistic view.* Each of us needs to teach our students how to read pertinent materials and evaluate arguments and evidence. We need to teach this interactively in class, not just explain them. Because each discipline has its own conventions for how to read a book, how to write papers, what makes a great essay question answer, and more, we each have to do this repeatedly in different courses. I suspect that most students who are ready to start college without such help learned these skills in multiple AP courses.

*Dysfunctional illusion of rigor 5.* Traditional methods of instruction are unbiased and equally fair to a range of diverse students of good ability.

When I attended my first workshops on cultural and other biases in college teaching, I was shocked at the idea that courses such as calculus, physics, and biology were thought to be anything but nearly fully objective in both content and pedagogy.

*More realistic view.* Traditional methods of instruction favor students who have had multiple AP courses and have otherwise had the exceptional preparation for college offered by elite high schools. In addition, many or most such students come from well-off families, families that also have high expectations for academic success.

Rose (1990) convinced me that unintended discrimination is inherent in any assumption that students should come to us knowing how to read the

way we want them to read, how to write the way we want them to write, and generally how to do the various tasks required to excel in our courses properly. Treisman's work (see above) convinced me that even well-prepared students (high math SATs) are often disadvantaged by high school experiences that lead them to work alone. My own high school math teacher taught us that checking your homework with another student is cheating. It was a shock to find Treisman describing years later my solitary approaches to studying. It was an even greater shock to find him suggesting that if faculty didn't like the usual levels achieved by less-privileged students, they needed to build the social support required for learning.

*Dysfunctional illusion of rigor 6.* It is essential that students hand in papers on time and take exams on time. Giving them flexibility and a second chance is pampering the students.

*More realistic view.* Giving limited time flexibility on some assignments and a limited number of repeats on exams can be a way of fostering increased achievement and increasing fairness.

After I began to understand how standard classroom practices discriminated against students from less-privileged backgrounds, I asked myself what I was assuming when I gave an exam only once to a freshman biology class. It seemed that I was assuming that the student knew what it would feel like to have mastered the content at the university A level, that she had a realistic idea of how long this would take, and that she had control over her own time.

I hadn't understood that she might not have full control of her own time if, for example, she were a single parent with two children who caught the flu in the week before the exam, or if she had a real job and was ordered to take extra shifts to make up for someone who had the flu. Thus, the idea that students should be able to manage time equally is another idea that favors privileged students, in the sense that it assumes things that are most likely to be true of traditional age students with limited other responsibilities.

I reluctantly decided that I should give each exam twice. Initially, so as not to cut into coverage, I offered the second try in the evening at a time possible for everyone who wanted to take the exam. Students kept the better of the two grades. Performance improved markedly. I ultimately saw that studying twice for exams (which not every student did) taught on average more content than another lecture would have. I then started giving both exams in class time. Once this approach to exams proved successful, I adopted it in all courses (Nelson, 1996, in press-a).

I then asked myself whether I should continue to insist on rigid deadlines for other assignments. I ended up separating deadlines into two



groups. Some were essential for my classes to function well. Preparation for discussion had to be done on time or the discussion would not work. I could allow limited flexibility on some other deadlines. Would it really matter if some lab reports were a bit late? On these, limited time flexibility might be appropriate. Perhaps lab reports would improve if students were allowed as many late days total as there were lab reports, with a penalty if the total were exceeded.

I have no evidence to support these practices beyond the fact that they worked for me and the feeling that they will obviously improve learning. I have found that many other faculty are fairly sure that they would also improve grades in their courses—and that like me, they initially are reluctant to sacrifice coverage or are worried that flexibility might lower standards. I suspect they will find that flexibility improves learning. Part of the change may be in students' attitudes. Students remarked that I had made it unusually clear that I really cared whether they learned and said that they consequently were trying harder.

*Dysfunctional illusion of rigor 7.* If we cover more content, the students will learn more content.

As evidence of my strong initial adherence to this view, I initially regretted each class period given over to an exam as a period in which I could not cover more of the important and fascinating biology. So much would have had to be left uncovered even if there were no exams.

*More realistic view.* The best courses are those that most successfully achieve the outcomes we see as most important. Initially, I was most strongly focused on content, especially on conceptual mastery.

The studies already discussed show that learning, student retention, and equity can be strongly increased by adopting active learning, by actively teaching students how to read and write within the framework of the course, and probably by allowing more flexibility on exams and deadlines. As I began to understand much of this, I realized with some dismay that I really was going to have to cover noticeably *less* material in class.

However, I stumbled on an approach that partially softened this blow, especially for courses for advanced majors. I transferred part of the coverage to work outside of class time. I knew that even advanced majors tended to learn relatively little from reading assignments. I decided to try using more detailed study guides. These guides would be of a set of essay questions from which any exam questions over that reading would be drawn in whole or part, thus ensuring that the students paid attention.

I first set out to write all reasonable essay questions over one chapter. My goal was to list each question that I might have written after just assigning the students to read the chapter. I reached about fifty questions

and was not yet done with the chapter. It was suddenly clear to me why As on my exams typically had previously started at 70 percent when I included several questions over the readings. There was entirely too much material for the students to be expected to learn, and I had not been providing much guidance as to what was important. More appallingly, I realized that I had not decided what I most wanted to achieve by assigning the chapter. Making those decisions required substantial effort but deepened my understanding of my objectives. After the first few chapters, these tasks became easier.

Soon I was giving the students a set of about twenty essay questions over each chapter well before the exam. Often I told them that some parts of the text could be skimmed, skipped, or read optionally. Most important, I often gave questions that asked for more careful analysis, synthesis, and critical thinking generally than I had been able to use previously. Even so, grades quickly rose: A's began at 90 percent. *Thus I found that by using guided reading I could foster out-of-class learning to teach some key aspects of the content more effectively than when I had lectured on it.* The fault lay not with my students but rather with my pedagogy. The new approach specified deeper and clearer learning objectives, gave substantial help in seeing how to reach them, and limited coverage both in lecture and by skipping parts of the text.

*Even more realistic view.* What I had come to gradually was an outcomes-based course design. Traditionally, we have chosen the most important content and covered it, hoping that outcomes such as critical thinking would automatically result from learning the content. An alternative approach starts by selecting the outcomes that one most wishes to foster and then choosing the pedagogies, and finally the content that seems most likely to achieve these outcomes. The American Association of Colleges and Universities ([www.aacu.org](http://www.aacu.org)) has strongly advocated and effectively illustrated such intentional approaches to effective education. Key books now aid faculty in understanding and designing courses with these approaches (Bean, 1996; Diamond, 2008; Fink, 2003; Grunert O'Brien, Millis, & Cohen, 2008; Mentkowski & Associates, 1999; Wiggins & McTighe, 2000).

### Switching from a Content-Centered Course to One Focused on Major Outcomes: Confronting a Major Illusion

The course I taught initially was evolution for senior majors. On the first exam, I asked what I thought was a give-away question, one requiring quite modest rearrangement of the content. Virtually all of the students failed the question. One woman asked for a clue as she left the exam, saying

essentially: "I thought about using this block of information, but it only had three parts, and about using this other block, but it only had four parts—but the question asked for five parts and I just couldn't think of anything that had five parts." I was stunned. Any five of the seven she listed could have sufficed! It was clear from such comments many of the students were working hard. I had somehow not prepared them for the exam. The A's started at 70. And they continued to start at 70 on subsequent exams so dependably over the next few years that I announced this new standard in my syllabi. I justified this standard to myself as teaching for critical thinking and as letting A students see further challenges.

### *Some Key Findings*

Perry (1970) found that many first-year students thought knowledge was truth acquired from authority and memorized. It was not in their power, they thought, to think further. Perry termed this approach, with its contrast between either really true or really false, *dualism*. This explained for me the student's comment about nothing having five parts. In areas where authority apparently had no clear answers, especially when authorities disagreed, a quite different standard prevailed: many students thought that in such areas an opinion was made valid simply by the act of affirming it, with no expectations of justification by evidence or other criteria. Perry termed this approach, with its emphasis on multiple but unjustified truths, *multiplicity*. Even as seniors, few students actually seemed to understand how to reason within disciplines; even fewer could justify stances that transcended single disciplines and took account of consequences, tradeoffs, and alternative approaches.

Faculty have assumed that a major part of higher education was reasoning within and across disciplines and thinking about complex real-world situations. But they usually have given little help to the students in moving to these approaches. Rather, many have presumed, as I did initially, that if we taught the content clearly, then critical thinking and other outcomes would arise more or less by induction. Perry's study helped to explain why my students were not learning to think critically from the ways I had been teaching the content.

### *Readily Available Models for Pedagogical Changes*

Several books that follow up on Perry's scheme include a major section on how to apply it or modifications of it to help students become more sophisticated (for example, Belenky, Clinchy, Goldberger, & Tarule,

1986; King & Kitchner, 1994). Some books have had such applications as their major focus (Baxter Magolda, 2000, 2001; Baxter Magolda & King, 2000, 2004; Mentkowski & Associates, 1999). Many articles have had similar emphases. As examples: Kloss (1994) presented a quick overview, and Finster (1991) applied Perry to general chemistry, thus showing how to use it in basic introductory science. Nelson discussed applications across the curriculum (1999) and, specifically, to evolution (2007) and environmental literacy (in press-b).

*Dysfunctional illusion of rigor 8.* A good, clear argument in plain English can be understood by any bright student who applies herself.

When I began teaching, I assumed that this was true. I had no real understanding of student difficulties and how to address them.

*More realistic view.* In brief, many students, even if quite bright, will be unable to understand our examples of critical thinking and of contextually constrained conclusions without much more support than is usually offered. It is clear that even very bright and relatively well-prepared students often have major problems; remember that the core difficulties here were first delineated by studying undergraduates at Harvard (Perry, 1970).

Rose (1990), and the other cases cited above, has clearly shown how a number of factors make our "clear" arguments inaccessible to many or even most of our students, including many of the most talented. These factors include our vocabulary and our conventions for how to read, what it is acceptable to write, how to answer exam questions, and so on. As noted above, the remedy for these problems, once recognized, is to use active learning to teach our students to understand these expectations and how to meet them.

The pedagogical problems raised by the studies that began with Perry are deeper and more recalcitrant. Perry's focus (1970) was intellectual and ethical development. Development means that students usually must master one form of thinking before they can really understand a more complex one. When I began teaching, I merged several levels without providing any signals or help to the students.

The more recalcitrant aspects of the problem of fostering complex critical thinking were captured initially by Perry's choice of "intellectual and ethical." Belenky et al. (1986) focused on the switch from reliance on others to make decisions to development of one's own voice. Baxter Magolda and King (2000) enlarged the objectives further: *Teaching to Promote Intellectual and Personal Maturity: Incorporating Students' Worldviews and Identities into the Learning Process*. In 2004 they encapsulated the goal as fostering "self-authorship," a term Baxter Magolda had also used

in 2000. Mentkowski and Associates (1999) stated the larger context as integrating learning, development, and performance. They presented both a synthesis of relevant literature and an exceptionally well-developed model of how to foster student change.

The essence is that to successfully foster critical thinking we must not only change the students' cognitive frameworks but also help them adapt their ethical frameworks, their sense of agency and self, and how they view others. In many cases, core difficulties in advancing in critical thinking flow from these other dimensions of concurrent change. Hence the need to broaden pedagogies, as advocated and illustrated by Baxter Magolda and King (2000, 2004), Mentkowski and Associates (1999), and others. Explicitness, attention to the level of argument, and use of active learning together go a long way.

### Switching from Idiosyncratic Practices to Scholarly Pedagogy and Curricular Design: Confronting the Central Illusion

The previous sections argue that the extent and quality of learning can be greatly improved using insights from the pedagogical literature. But few faculty have had any introduction to taking such a scholarly approach. This is changing. For example, twenty-nine programs at Indiana University now offer discipline-based, graduate courses in teaching for Ph.D. students ([www.iub.edu/~teaching/allabout/prepare/pedagogy.shtml](http://www.iub.edu/~teaching/allabout/prepare/pedagogy.shtml)).

*Dysfunctional illusion of rigor 9.* Without further study, faculty know enough to revise their courses and departments know enough to revise their curricula. Course and curricular revision are primarily about deciding what content to cover in what courses.

When I started teaching, I was not aware of any helpful pedagogical research. Indeed, some senior members of my departments said that good teachers were born, not trained; they explicitly discouraged asking for help from faculty in science education. Most of the curricular revisions I have been privy to over the last forty years assumed that appropriate teaching and curriculum really could be figured out by one or a few faculty members with little or no systematic perusal of evidence or of examples from elsewhere.

*More realistic view.* Teaching and curricula revision should be informed by pedagogical and curricular research and by an examination of best practices elsewhere.

Before initiating a new disciplinary research project, one would need to know the already existing research base. Similarly, for both teaching

D  
a  
n  
d  
e  
  
ta  
R  
m  
Sc  
Se  
As  
su  
as  
(H  
  
Co  
If  
co

T  
reg  
app  
me l  
supj  
pres  
mas  
prac

and curricular revision one should know current best practices at least nationally and either adopt those practices or be able to argue, with evidence, for doing something else. Further, it is important to assess the extent to which one's attempts are achieving what one intends.

Current best practices for pedagogy within a discipline can be ascertained by scanning the appropriate pedagogical journals (see *Periodicals Related to College Teaching* at [www.indiana.edu/~sotl/](http://www.indiana.edu/~sotl/)) or by checking meeting abstracts (for example, those of the International Society for the Scholarship of Teaching & Learning at [www.issotl.org/conferences.html](http://www.issotl.org/conferences.html)). Searches for current best practices in curricula might start with the Association of American Colleges and Universities (<http://aacu.org/>). The success of one's teaching can be examined with, for example, classroom assessment techniques (Angelo & Cross, 1993) or course portfolios (Hutchings, 1998).

### Conclusion

I first wrote about some of these ideas in 1996. I reached three important conclusions.

- There is no doubt that we know how to make a massive difference in overall student achievement, including gains in comprehension, application, synthesis, retention, and enthusiasm.
- These nontraditional approaches usually produce large gains by the groups of students who have been hardest to reach with standard pedagogy. Clearly, if no one is making an F<sub>3</sub>, then no one from the hard-to-reach groups can be making an F either.
- The evidence that these alternative pedagogies are more effective and equitable is so strong that it seems to me that the burden of proof has shifted. Anyone using a relatively unmodified traditional pedagogy might well be required to show that it is at least as effective in producing student learning as it would be if enriched with a generous admixture of nontraditional approaches.

These conclusions still hold. I realized even then that I had been quite regrettably slow to grasp these ideas myself and even slower to make appropriate changes in my pedagogies. I now see that key problems for me lay in a series of dysfunctional illusions that tended, conveniently, to support my existing practices and make them resistant to change. I have presented some examples here hoping that they may help others find and master some of their own illusions and more seriously consider revised practices.

## REFERENCES

- Angelo, T. A., & Cross, K. P. (1993). *Classroom assessment techniques: A handbook for college teachers* (2nd ed.). San Francisco: Jossey Bass.
- Barkley, E., Cross, K. P., & Howell Major, C. (2004). *Collaborative learning techniques: A handbook for college faculty*. San Francisco: Jossey-Bass.
- Baxter Magolda, M. B. (2000). *Creating contexts for learning and self-authorship: Constructive-developmental pedagogy*. Nashville, TN: Vanderbilt University Press.
- Baxter Magolda, M. B. (2001). *Making their own way: Narratives for transforming higher education to promote self-development*. Sterling, VA: Stylus.
- Baxter Magolda, M. B., & King, P. M. (Eds.). (2000). *Teaching to promote intellectual and personal maturity: Incorporating students' worldviews and identities into the learning process*. San Francisco: Jossey-Bass.
- Baxter Magolda, M. B., & King, P. M. (Eds.). (2004). *Learning partnerships: Theory and models of practice to educate for self-authorship*. Sterling, VA: Stylus.
- Bean, J. (1996). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. San Francisco: Jossey-Bass.
- Belenky, M., Clinchy, B., Goldberger, N., & Tarule, J. (1986). *Women's ways of knowing: The development of self, voice, and mind*. New York: Basic Books.
- Bonwell, C. C., & Eison, J. A. (1991). *Active learning: Creating excitement in the classroom* (ASHE-ERIC Higher Education Report No. 1). Washington, DC: George Washington University, School of Education and Human Development.
- Colomb, G. G. (1986). *Disciplinary secrets and the apprentice writer*. Institute for Critical Thinking. Upper Montclair, NJ: Montclair State College.
- Cooper, J. L., Robinson, P., & Ball, D. (Eds.). (2003). *Small group instruction in higher education: Lessons from the past, visions of the future*. Stillwater, OK: New Forums Press.
- Diamond, R. M. (2008). *Designing and assessing courses and curricula* (3rd ed.). San Francisco: Jossey-Bass.
- Fink, L. D. (2003). *Creating significant learning experiences: An integrated approach to designing college courses*. San Francisco: Jossey-Bass.
- Finster, D. C. (1991). Developmental instruction: Part II. Application of the Perry model to general chemistry. *Journal of Chemical Education*, 68(9), 753-756.
- Froyd, J. E. (2007). *Evidence for the efficacy of student-active learning pedagogies*. Retrieved December 8, 2008, from [www.pkal.org/documents/BibliographyofSALPedagogies.cfm](http://www.pkal.org/documents/BibliographyofSALPedagogies.cfm)

Fullilov  
A  
Be  
of  
Grunert  
A  
Hake, R  
th  
co  
Handels  
et  
Hutchin  
the  
VA  
Jacobs, I  
the  
Rei  
col  
Johnson,  
the  
King, P. I  
Un  
adc  
Kloss, R.  
of i  
Kuh, G. I  
Mentkow  
ing,  
Joss  
Millis, B.  
facu  
Nelson, C  
teaci  
165-  
Nelson, C  
tent  
(Eds  
a nei  
Nelson, C  
alter

- Fullilove, R. E., & Treisman, P. U. (1990). Mathematics achievement among African American undergraduates at the University of California, Berkeley: An evaluation of the Mathematics Workshop Program. *Journal of Negro Education*, 59(3), 463-478.
- Grunert O'Brien, J., Millis, B. J., & Cohen, M. W. (2008). *The course syllabus: A learning-centered approach* (2nd ed.). San Francisco: Jossey-Bass.
- Hake, R. R. (1998). Interactive engagement vs. traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64-74.
- Handelsman, J., Ebert-May, D., Beichner, R., Bruns, P., Chang, A., DeHaan, R., et al. (2004). Scientific teaching. *Science*, 304(5670), 521-522.
- Hutchings, P. (Ed.). (1998). *The course portfolio: How faculty can examine their teaching to advance practice and improve student learning*. Sterling, VA: Stylus.
- Jacobs, D. C. (2000). *An alternative approach to general chemistry: Addressing the needs of at-risk students with cooperative learning strategies*. Retrieved December 8, 2008, from [http://cms.carnegiefoundation.org/collections/castl\\_he/djacobs/index2.html](http://cms.carnegiefoundation.org/collections/castl_he/djacobs/index2.html)
- Johnson, D., Johnson, R., & Smith, K. (2006). *Active learning: Cooperation in the college classroom* (3rd ed.). Edina, MN: Interaction Books.
- King, P. M., & Kitchner, K. S. (1994). *Developing reflexive judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults*. San Francisco: Jossey-Bass.
- Kloss, R. J. (1994). A nudge is best: Helping students through the Perry scheme of intellectual development. *College Teaching*, 42(4), 151-158.
- Kuh, G. D. (1998). Lessons from the mountains. *About Campus*, 3(2), 16-21.
- Mentkowski, M., & Associates. (1999). *Learning that lasts: Integrating learning, development, and performance in college and beyond*. San Francisco: Jossey-Bass.
- Millis, B. J., & Cottell, P. G. (1997). *Cooperative learning for higher education faculty*. Phoenix, AZ: American Council on Education and Oryx Press.
- Nelson, C. E. (1996). Student diversity requires different approaches to college teaching, even in math and science. *American Behavioral Scientist*, 40(2), 165-175.
- Nelson, C. E. (1999). On the persistence of unicorns: The tradeoff between content and critical thinking revisited. In B. A. Pescosolido & R. Aminzade (Eds.), *The social worlds of higher education: Handbook for teaching in a new century* (pp. 168-184). Thousand Oaks, CA: Pine Forge Press.
- Nelson, C. E. (2007). Teaching evolution effectively: A central dilemma and alternative strategies. *McGill Journal of Education*, 42(2), 265-283.