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Classroom Teaching Practices: Ten Lessons Learned

Alberto F. Cabrera
Department of Educational Administration
University of Wisconsin at Madison
Estados Unidos

Steven M. La Nasa
George Mason University
Estados Unidos

Abstract

Mejorar la calidad de la Educación Superior requiere que se mejora la enseñanza y el aprendizaje. Pero en que consiste la buena enseñanza no siempre está claro, y hay diferentes perspectivas en cuanto a docentes, estudiantes o externos. Este capítulo revisa lo que hemos aprendido acerca del aprendizaje, y lo que sabemos, pero no lo queremos aprender.

1. Introduction

This manuscript provides a brief overview of ten key lessons we have learned regarding effective classroom teaching practices. In talking about teaching, we have to define first what we mean by effective teaching. In all honesty, we lack consensus as to what effective teaching is all about. Whenever, the topic of effective teaching is brought to bear in research and practice circles, the biblical story of the Tower of Babel comes to mind: a raucous mob speaking in different tongues all at the same time. So let us briefly review three main perspectives on effective teaching.

One perspective defines effective teaching in terms of what teachers themselves consider effective teaching to be all about. After conducting a meta-analyses of 31 studies, Feldman (1988) concluded that faculty's three top choices of instructional dimensions were: a) knowledge of the subject, b) enthusiasm for teaching or for the subject, and c) sensitivity to, and concern with, class level and progress, in that order. The second approach defines effective teaching from a student's perspective (Young & Shaw, 1999). Feldman found that students' top choices of effective teaching were, in order of importance: a) sensitivity to, and concern with, class level and progress, b) teacher's preparation; organization of the course, and c) teacher's stimulation of interest in the course and its subject matter. Still another approach is to regard effective teaching as those instructional techniques and practices both teachers and students agree to be effective. Feldman found that both students and teachers concur in defining effective instruction in terms of course preparation and organization of the class. And yet, discrepancies remain between teachers and students. If judged under the lenses of faculty, then, effective teaching would be defined in terms of knowledge and holding high standards. From a student's perspective, one would define effective teaching in terms of the outcomes of instruction. To avoid the problem of multiplicity of perspectives, we are going to adopt a very simple definition of effective teaching in this manuscript, a definition that is consistent with the one fostered by major accrediting programs of higher education (e.g. Accreditation Board for Engineering and Technology, 1998; Middle States Association for Colleges & Schools, 1996); namely,

Effective teaching is one that produces demonstrable results in terms of the cognitive and affective development of the college students.

Having clarified what we mean by effective teaching, we need to provide a brief description of how we are going to address our topic. The first section will devote itself to review what we have learned about the nature of college teaching.

In a nutshell, college teaching is comprised by several behaviors a professor displays in class. This section will briefly review the nature of those teaching behaviors. The second section will provide some advise regarding the assessment of teaching. This advice can be summarized as follows: be alert of what you measure, you may not be measuring teaching behaviors at all! The third section will describe how knowledge of effective teaching is affecting American colleges and universities. If judged in terms of what faculty do, the answer is not too much change at all. Though, we know what effective teaching is all about few of us practice it. This section will also describe the major forces of change that promise to revamp the way we think about teaching in the United States.

2. What do we know about college teaching?

After almost 40 years of substantial research on college teaching we have learned our first lesson: good teaching can promote student learning and development (Cabrera, Colbeck & Terenzini, 1999; Feldman, 1989; Feldman & Paulsen, 1994; Murray, 1990). The second lesson we learned is that in understanding teaching we need to recognize the fact that learning itself is a social phenomenon (Cockrell, Caplow & Donaldson, 2000). In this social context, teaching is but one of many factors that affect student development. Consequently, before reviewing the nature of teaching in itself, we need to first address some contextual issues.

2.1. Teaching for Competence model

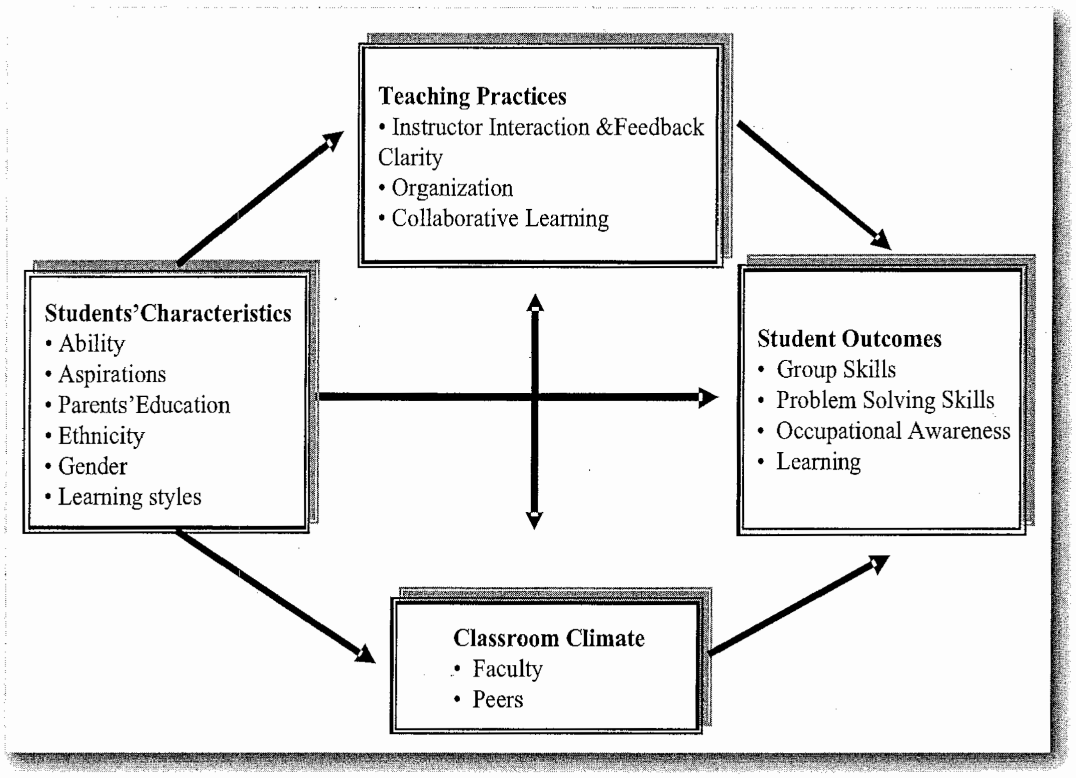
Advanced by Cabrera, Colbeck and Terenzini (1999), the Teaching for Competence Model (see Figure 1) argues students' outcomes such as learning takes place in a context shaped by the students' own characteristics, the instructional practices they encounter in the classroom, and classroom climate created by the professor and the peers. In terms of students' characteristics, the model posits that students are likely to learn when they have the appropriate academic ability and the motivation to do collegiate work. Students' own learning styles also matter. They provide the ways in which students can make sense of the reality surrounding them (Kolb, 1984). These learning styles are affected by gender (Belenky, Clinchy, Goldberger, & Tarule , 1986), ethnicity (Hurtado, 1992; Cabrera & Nora, 1994), and the particular discipline the student is pursuing (Kolb, 1984). Classroom experiences include exposure to teaching methods, the curriculum, and the classroom climate emerging by the nature of interactions among peers and with faculty. Though both classroom experiences and classroom climate contribute to student development (Pascarella & Terenzini, 1991; Kuh, Douglas, Lund & Ramin-Gyurnek, 1994), classroom experiences appear to have a stronger and more varied effect on student outcomes (Cabrera, Colbeck & Terenzini, 1999;

Colbeck, Cabrera & Terenzini, in press; Volkwein, 1991; Volkwein & Lorang, 1996). The model also presumes that a student's characteristics, teaching practices and classroom climate have a unique contribution on student development, reinforcing one another.

2.2. The learner as a component of teaching: Learning styles, ability and background

Among factors known or presumed to affect students' learning in college one can find: students' own intellectual ability, their educational aspirations, and the education level attained by their parents (Astin, 1993, Pascarella & Terenzini, 1991). Central in all of this are the student's learning styles themselves.

Figure 1. Teaching for Professional Skill Development Model



Kolb (1984) argues that individuals experience learning on the basis of concrete experiences, conceptualizing of experiences, working with ideas or concepts or actively experimenting with or manipulating objects. Kolb arranged these four cognitive styles under two cognitive domains that may be seen as two poles of a continuum: a) the concrete-reflective domain and b) the abstract-active experimentation domain. Table 1 summarizes the components of each of the two learning domains.

Table 1. Cognitive domains and strategies.

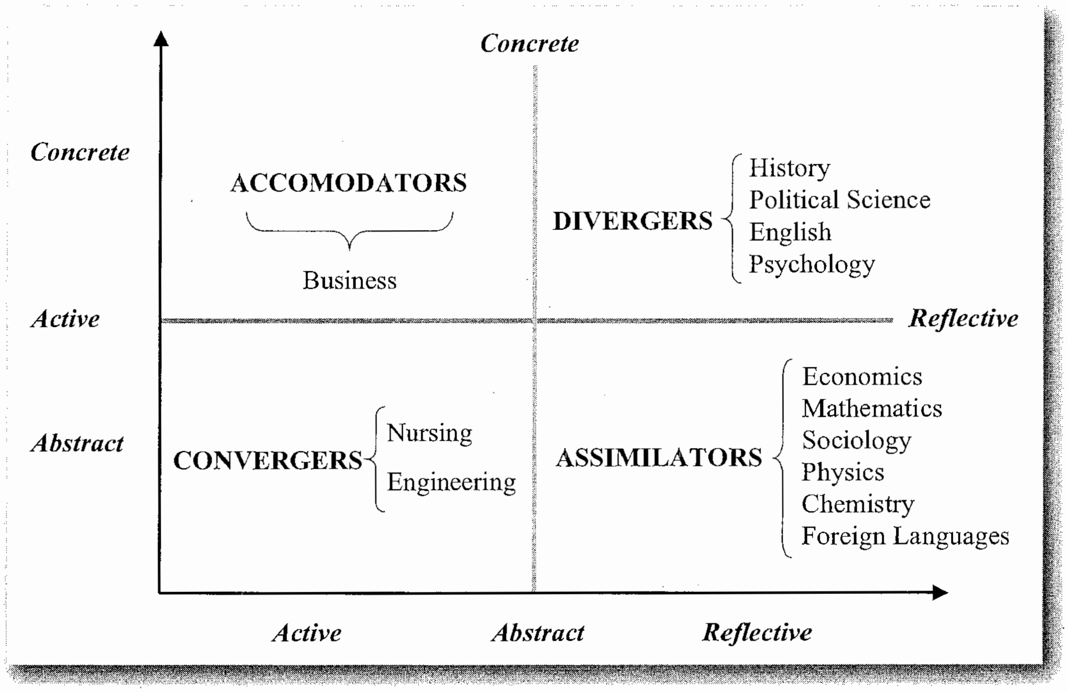
Concrete-Reflective Domain		Abstract-Active Domain	
Concrete Experience	Reflective Observation	Abstract Conceptualization	Active Experimentation
Affective: Dealing with people. Being sensitive to values. Being sensitive to people's feelings. Being personally involved. Working in groups.	Perceptual: Gathering information. Organizing information. Listening with an open mind. Seeing how things fit in the big picture. Developing comprehensive plans. Imagining implications for ambiguous situations.	Symbolic: Testing theories & ideas. Analyzing quantitative data. Experimenting with new ideas. Designing experiences. Generating alternative ways of doing. Building concept models.	Behavioral: Making decisions. Seeing & exploiting opportunities. Setting goals. Committing self to objectives. Able to adapt to changing circumstances. Influencing & leading others.

Kolb further postulated the intersection of these two domains produces four learning styles in which two of the four cognitive traits dominate. These learning styles are:

1. Convergent. Dominant learning style stresses abstract conceptualization and active experimentation.
2. Divergent. Dominant learning style stresses concrete experiences and reflective observations.
3. Assimilator. Dominant learning style stresses conceptualizations and reflective observations.
4. Accommodator. Dominant learning style stresses concrete experiences and active experimentation.

In the Kolbian model, learning is maximized most when the classroom environment matches any of the four learning styles. Kolb also noticed that academic disciplines seem to call for different learning styles. Having collected learning scores from 800 managers, Kolb found that learning styles correlated with particular majors, a discovery leading him to postulate that certain learning styles as best fitting specific majors (see Figure 2).

Figure 2. Learning styles & majors. Adapted from Kolb (1984)



Students' preferences towards learning styles have been well documented by research other than Kolb's. Pask (1988) for instance, demonstrated students learn best when the instructor's teaching style matches their learning preferences; mismatches, on the other hand, lessened this learning. Research has also shown that students tend to study in academic disciplines most resembling their learning styles (Feldman, 1989). Under some conditions, gender and race can also influence what and how students learn (Oakes, 1990). Opinions differ, however, about the reasons for gender and race-related learning differences. The most compelling argument lies on differences in learning styles (Belenky, Clynchy, Goldberger & Tarule, 1986; Lundeberg & Diemert, 1995; Baxter-Magolda, 1992; Martínez-Alemán, 1997). According to this approach, women and minorities are more likely than white men to prefer collaborative learning settings because their learning styles emphasize connected knowing, cooperative problem solving, and socially based knowledge. In contrast, men (and some women educated in college by men) may be more likely than other women to prefer traditional pedagogy given their more analytical, individualistic, and competitive learning styles (e.g. Belenki, at al., 1986). Research evidence regarding gender or race based learning styles is mixed. Lundeberg and Diemert's (1995) qualitative study of women attending a private, single-sex midwestern college found women did prefer collaborative learning. Lundeberg and Diemert also observed the collaborative nature of the student interactions promoted intellectual risk taking and connected understanding of concepts. On the other hand, Tinto (1997) found collaborative learning effective in promoting persistence in college, regardless of a student's gender or race/ethnicity.

Summing up, the third lesson we have learned is students have different ways of knowing whose effectiveness may vary by type of academic discipline or major, gender and ethnicity.

2.3. Teaching as a component of classroom experiences

Interest in classroom experiences has increased as research mounts regarding their connection with a diverse array of student outcomes, including academic and cognitive development, knowledge acquisition, clarity in educational goals, interpersonal skills, and the quality of student effort spent in academic activities (e.g. Astin, 1993; Colbeck, Cabrera, Terenzini, in press; Murray, 1990; Pascarella & Terenzini, 1991; Tinto, 1997; Volkwein, 1991; Volkwein & Lorang, 1996; Volkwein & Cabrera, 1998). This research also shows that teaching practices are part of a complex process defining classroom experiences. Those experiences embrace teaching practices, the delivered curriculum as perceived by the students, and the climate permeating interactions among students and between the instructor and the students (Cabrera & Nora, 1994; Ewell, 1996; Stark & Latuca, 1997).

2.4. Teaching as a multidimensional phenomenon

The two lessons we have learned from research on classroom experiences are: a) college teaching is multidimensional in nature (Lesson 4), and b) the effectiveness of each college teaching dimension s varies as a function of the student outcome under consideration –Lesson 5– (Cabrera, Colbeck & Terenzini, 1999; Colbeck, Cabrera & Terenzini, in press, McKeachie, 1988, 1990; Murray, 1990; Kulik & Kulik, 1979).

The dimensions of teaching. Teaching embodies a variety of classroom behaviors. Having observed 24 professors of political sciences in the classroom, Solomon, Rosenberg and Bezdek (1964) reported faculty engaging in 169 teaching variables. Subsequent factor analyses of those 169 teaching variables revealed 8 underlying dimensions; namely, 1) control vs. permissiveness, 2) lethargy vs. energy, 3) protectiveness vs. aggressiveness, 4) vagueness vs. clarity, 5) emphasis on student growth, 6) dryness vs. flamboyance, 7) emphasis on participation, and 8) coldness vs. warmth. As important as this study was in highlighting the multidimensionality of teaching practices, several methodological problems prevented us from reaching firm conclusions. To begin with, many of the teaching practices reported by the researchers consisted of global and vague traits difficult to report by observers other than the researchers themselves; this is to say, many of the classroom activities Solomon and associated documented demanded high-inference on the part of the observer (e.g. clarity, informality, flexibility). Reliance on a handful of observers compounded the problem of using of high-inference practices still further (Murray, 1990). However, the study's key finding regarding the multifaceted nature of teaching prompted a series of studies regarding the nature of the teaching function. In this sense, Murray's studies are seminal.

Twenty-one years after Solomon and associates' study, Murray (1985) replicated their findings regarding the multifaceted nature of college teaching. In order to avoid the methodological pitfalls Solomon and associates encountered, Murray focused on observable (low-inference) teaching behaviors rather than on vague or global traits that call for a high degree of inference on the part of the observer (high-inference). He also relied on trained observers rather than on students. Once these ratings were collected over a five-year period of time in a multiple section of introductory psychology, Murray found that these behaviors could be grouped into six dimensions. Those were: 1) enthusiasm, 2) clarity, 3) interaction, 4) task orientation, 5) rapport and 6) organization.

As seminal as the Murray's study was and the research on teaching behaviors it prompted (Murray, 1990), its reliance on a handful of majors (e.g. political science, psychology, arts, natural sciences) has raised questions regarding the generalizability of its findings to another disciplines. Do professors in other fields engage in a variety of teaching practices? A recent study answered the question of the multidimensionality of teaching behaviors as far as engineering is concerned. Cabrera, Colbeck and Terenzini (1999) examined the extent to which 1,258 engineering students observed their instructors being engaged in 20 classrooms behaviors. All those teaching behaviors were drawn from the research literature on effective instructional practices and activities. A principal components factor analysis of these low-inference teaching behaviors produced 3 groups of teaching practices interpreted as Collaborative Learning, Instructor Interaction and Feedback and Clarity and Organization. Table 2 lists each of the classroom behaviors comprising each dimension. Their results, then, clearly show their capacity in such hard majors as engineering do use a variety of teaching practices as complex as the ones engaged by their peers in other disciplines (Murray, 1990). Equally important in this study is the discovery that students themselves can be reliable raters of the teaching behaviors they observe. The alpha coefficients for each teaching dimension ranged from .77 to .88, alpha coefficients values well above the .70 benchmark for scales considered to be highly reliable (Litwin, 1995).

Table 2. Results of Cabrera, Colbeck & Terenzini (1999) study.

Teacher behavior Factors and highest loading behaviors	Teaching Dimensions		
	Collaborative Teaching	Instruction Interaction & Feedback	Clarity & Organization
Discuss ideas with classmates	.822		
Wok cooperatively with students	.739		
Opportunities to work in groups	.753		
Get feedback from classmates	.753		
Students teach & learn from one another	.679		
Interact with classmates outside of class	.650		
Required participation in class	.589		
Interact with instructor as part of the course		780	
Interact with instructor outside of class		.741	
Instructors gives detailed feedback		.713	
Instructor gives frequent feedback		.689	
Guided student learning, versus lecturing		.578	

Teacher behavior Factors and highest loading behaviors	Teaching Dimensions		
	Collaborative Teaching	Instruction Interaction & Feedback	Clarity & Organization
Assignments/activities clearly explained Assignments/presentations clearly related Instructor makes clear expectations for activities			.767 .722 .677
Internal Consistency Reliability (Alpha)	.88	.83	.77

Effective teaching practices. Earlier we defined teaching effectiveness in terms of their effects on students. This connection brings us to the fifth lesson we have learned: not only are teaching practices multidimensional, each teaching dimension plays a varied and complex role on a student's cognitive and affective development. Table 3 summarizes research findings regarding the linkage between teaching practices and students' outcomes.

Table 3. Teaching practices & students' outcomes

Teaching Practice	Student Outcomes
Teaching clarity	• Motivation to re-enroll in courses • Achievement • Academic effort
Continuous & specific feedback	• Achievement
Lecturing	• Acquisition of knowledge
Class discussion	• Problem solving skills • Long-term retention of knowledge
Problem solving methods	• Critical thinking skills • Long term retention of knowledge • Acquisition of knowledge • Achievement
Coaching	• Design skill

Teaching Practice	Student Outcomes
Collaborative learning	• Persistence in college • Problem solving skills • Long term retention of knowledge • Group skills • Design skills • Intellectual risk-taking • Connected knowledge • Achievement • Openness to diversity • Academic effort • Understanding science & technology • Analytical skills

Teacher clarity and organization, for instance, has been found to correlate with student motivation to re-enroll in courses (Murray, 1983), student achievement (Feldman, 1989; Murray, 1990), self-reported gains in knowledge (Solomon, Rosenberg & Bezdek, 1964), problem solving and in occupational awareness (Cabrera, Colbeck & Terenzini, 1999). Continuous, specific and immediate feedback has been found to improve mastery of foreign languages (Cardelle & Corno, 1981) and achievement (Kulik & Kulik, 1979). While both lecturing and class discussion correlate with acquisition of knowledge, class discussion appears to be more effective for enhancing problem solving skills (Kulik & Kulik, 1979). In addition to class discussion, students' critical thinking skills can be positively influenced by encouragement from teachers and a teacher's articulation of problem solving procedures (McKeachie, 1988, 1990). Explaining assignments and activities, clearly stating course expectations, and articulating assignments to the content of the class are some of the teaching practices that have been found to enhance a student's ability to solve problems (Cabrera, Colbeck & Terenzini, 1999).

Of the teaching practices, collaborative learning has been singled out as the most promising to bring about student development (Gamson, 1994; Tinto, 1997, 1998). Collaborative learning, extensively used and researched in the K-12 arena (Slavin, 1990), emerged as an important pedagogy in higher education during the late 1980s (Bruffee, 1993; Goodsell, Maher, & Tinto, 1992). Collaborative learning departs from traditional learning theory in that it is premised on the notion learning is socially based (Cokrell, Caplow & Donaldson, 2000). Accordingly, collaborative learning restructures the classroom away from the traditional lecture to small group work requiring intensive interactions between students and the faculty member while working through complex projects. Through completion of projects, learning is supposed to be enhanced as students build upon their personal experiences while working with other students espousing a variety of views and skills. In this context, the role of faculty is as facilitator rather than as a knowledge source (Bruffee, 1993; Johnson, Johnson, & Smith, 1992; Slavin, Karweit, & Madden, 1989). Collaborative learning, in all its manifestations (e.g. peer-learning, peer tutorial, problem case solving), has been found to positively correlate with problem solving, long term retention of knowledge, achievement, application of concepts, sensitivity to fellow students' feelings, positive attitudes toward subject area, student leadership behavior, occupational awareness, student openness to diversity, gains in groups skills, and persistence (Cabrera, Colbeck & Terenzini, 1999; Cabrera, Nora, Bernal, Terenzini & Pascarella, 1998; Cokrell, Caplow & Donaldson, 2000; Johnson, Johnson & Smith, 1991; Levine & Levine, 1991; McKeachie, 1990; Pascarella & Terenzini, 1991; Tinto, 1997).

The impact of teaching practices extends well beyond cognitive issues; they also matter for a student's affective development. The more faculty interact with students, provide frequent and detailed feedback, create opportunities for collaborative learning and make assignments and expectations clear, the greater the gains in students' intentions to complete their degrees, sense of responsibility for their own learning, confidence, and motivation to pursue their majors. Moreover, students become more aware of what their future occupations may look like as a result of their interactions and feedback from instructors (Colbeck, Cabrera & Terenzini, in press; Cabrera, Colbeck & Terenzini, 1999).

2.5. Classroom Experiences: Classroom Climate

The sixth lesson we have learned is: the nature of the relationships permeating the interaction among students, and between students and faculty is as important for student learning and development as is teaching. A classroom climate saturated by prejudice and discrimination on the part of faculty and peers has emerged as an explanatory factor accounting for differences in college adjustment, majoring in hard sciences, and persisting in college between white men, women and minority students (Cabrera, Colbeck & Terenzini, 1999; Cabrera & Nora, 1994; Cabrera et al., 1999; Colbeck, Cabrera & Terenzini, in press; Drew, 1996, 1992, 1994; Eimers & Pike, 1997; Fleming, 1984; Whitt et al., 1998). On the other hand, faculty can play a pivotal role in enhancing the quality of the classroom climate. Faculty who foster equity and tolerance improve the vitality of the classroom experience to the point of overcoming the negative role of perceptions of prejudice and discrimination (Volkwein & Cabrera, 1998).

3. On assessing teaching & student outcomes

Several strategies and methods have been applied to the assessment of teaching. These include faculty peers, unobtrusive observers that sit in the classroom pretending to be students, recording, videotaping, and even reviewing samples of classroom assignments (Ewell, 1996, Murray, 1990). In doing so, the seventh lesson we learned is: trust the students for they are excellent raters of what takes place in the classroom. The key in producing reliable assessmements of teaching lies on what is being assessed. Murray's (1990) review of the literature led him to conclude that classroom teaching ratings tend to be reliable whenever observable (low-inference) teaching behaviors are the focus of evaluation. The rule is simple: traits or global measures (e.g. flexibility, caring for students) tend to produce low agreement among raters, while observable teaching behaviors (e.g. instructor explains class assignments clearly) increases it. For instance, Cabrera, Colbeck and Terenzini's (1999) found that the1,250 engineering students under study provided quite consistent ratings for each of the 20 teaching behaviors under consideration. The level of rating error in each of the three teaching dimension they evaluated ranged from as low as 12% to as high of 23%; a very low level of rating error in social sciences. Hativa and Birenbaum (2000) reached similar results while examining student evaluations of teaching behaviors among engineering and education undergraduates at a major Israeli university. The reliabilities for the four behavioral-based teaching scales they employed ranged from .82 to .94, representing a measurement error ranging from 6% to 18%.

Assessing student cognitive and affective outcomes is as important as evaluating teaching practices. Judgments of effective teaching rest on strong correlations between teaching and student outcomes (Murray, 1990). During the last 20 years considerable progress has been made in assessing cognitive and affective development of the students before they enter in college and as result of their exposure to college. Table 4 displays some of the most important measures seeking to capture the cognitive and affective development of the student before and during and as a result of college.

Table 4. Cognitive and affective measures.

Basic & Entry-Level: Attitudes, Motivation, Aspirations	College Related
Aptitudes & Abilities • ACT Collegiate Assessment of Academic Proficiency (CAAP) • SAT-Math, Verbal • ACT ASSET (Reading, Writing, Numerical, & Study Skills) • CLEP-Composition • College Board English Composition • Nelson Denny Reading • Doppelt Math • ACT COMPASS • High School GPA and rank	Skills, Competencies, Gains • ACT Assessment • College BASE: Reading, literature, writing, general math, algebra, lab & field work, history, social science (Osterlind & Merz, 1992) • Watson Glazer-Critical Thinking • ETS Descriptive Test of Language Skills • ACT's CAAP • College GPA • Student's portfolio • Pace's (1987) College Student Experiences Questionnaire (CSEQ) • Proficiency exams • Course patterns vs formal curriculum • Student credit hours

Basic & Entry-Level: Attitudes, Motivation, Aspirations	College Related
Motivation, Aspirations • College Board/ASQ Admitted Student Questionnaire • ACT Entering Student Survey • CIRP/HERI Student Information • NCHEMS Entering Student Questionnaire	Collegiate Experiences, Goal Attainment & Growth • Pace's (1987) College Student Experiences Questionnaire • Astin's (1993) College Student Survey • ACT Evaluation Survey Services (ESS) • Self-Reported Growth • Student portfolio • Community College Student Experiences Questionnaire • College Assessment Program Survey (CAPS) • Academic & Social Integration Scales (Pascarella & Terenzini, 1980)

Assessing cognitive development as a result of collegiate experiences has been approached under two lenses: a) 'objective' standardized tests, and b) self-reported measures of growth (see Table 4). The use of either approach has been controversial (Pike, 1995, 1996). Standardized tests not only are expensive to develop (Ewell & Jones, 1993), they may also fail to capture the full range of verbal, quantitative and analytical skills associated to different disciplines, curriculum and class-level teaching (Anaya, 1999). This is to say, standardized tests generally measure achievement accurately, but for a limited range of behaviors or content subject (Astin, 1993). Foundation in Engineering (FE) illustrates this problem. After substantial monetary and time expense, the much heralded ability of the FE test to capture knowledge all first-year students should master was doubted. Watson (1998) examined FE test results in the period 1993-96 for students in twelve engineering disciplines. He found FE test scores to correlate poorly with end of the year GPAs. Having examined the degree of association between FE test scores and GPA for each of the 12 engineering fields under study, Watson judged FE to be not applicable to all enginneering disciplines as the test was originally intended to accomplish. On the other hand, self-reported measures tend to measure a broad variety of behaviors and content; however, they may not be as precise as standardized tests (Astin, 1993). Questions about reliability of self-reported measures of growth is another problem.

Recent research has taught us lesson number eight: students may be as reliable in assessing their cognitive development resulting from classroom experiences as are standardized tests. After examining a representative sample of college students who took the GRE in 1989, Anaya (1999) concluded that self-reported measures of gains in math and verbal skills were valid proxies of cognitive skills as measured by the verbal and math components of the GRE. Likewise, Pike (1995) found self-reported measures of educational gains to have convergent validity with achievement tests (e.g. College BASE).

Extreme caution should be exercised when using self-reported growth measures as proxies of achievement tests, however. The National Center for Higher Education Management Systems recommended four criteria for using self-reported measures: a) they should represent broad-based outcomes, b) the measures should represent significant phenomena that could be used to inform policy makes, c) the measures should covariate with other assessments; and d) the observed relationships between these covariates should remain across different educational settings (Ewell et al., 1994). Recently, Pike (1995, 1996) demonstrated that self-measures should also meet a fifth condition: the self-reported measures should reflect the content of the learning outcome under consideration. He concluded that high content overlap between self-reported measures and test scores is a key consideration for using self-reported measures as proxies.

Developing content valid measures of cognitive growth is not an easy enterprise. It precludes a deep understanding of the cognitive and affective domains of a particular discipline and its curricular objectives (Astin et al., 2000; Ewell, 1996; Farmer & Napieralski, 1997). In short, valid cognitive measures are those in which learning is clearly connected with the curricular values and objectives (Astin et al., 2000). Jones and associates (1994a, 1994b, 1996, 1997), for instance, were able to identify the components of critical thinking, problem solving and communication skills engineering students should master after a series of carefully implemented Delphi studies among faculty members, administrators and employers.

Once the condition of content validity is met, however, students are quite reliable in assessing their cognitive growth. Using Pace's (1987) College Student Questionnare, Kuh, Pace and Vesper (1997), for instance, found that college students were highly reliable in assessing their cognitive gains in general education, personal-social development and intellectual skills. While relying on 23 items patterned after the themes identified by Jones and associates, Cabrera, Colbeck and Terenzini (1999) also reported a high degree of internal consistency among engineering students' self-reported gains in group skills, problem solving and occupational awareness as result of taking enginnering courses (See Table 5). The reliability of three cognitive growth domains was substantially high, ranging from .81 to .94. In other words, the margin of mearurement error ranged from 6% to 19%.

Table 5. Cognitive growth domains.

Self-reported growth measures	Factor Loadings		
	Group Skills	Problem-Solving Skills	Occupational Awareness
Developing ways to solve conflict & reach agreement	.779		
Being aware of feelings of members in group	.841		
Listening to the ideas of others with open mind	.829		
Working on collaborative projects as member of a team	.815		
Organizing information to aid comprehension	.679		
Asking probing questions that clarify facts, concepts	.606		
Developing alternatives that combine best from previous work	.618		
Ability to design		.578	
Solve an unstructured problem		.697	
Identify knowledge, resources & people to solve problem		.666	
Evaluate arguments and evidence of competing alternatives		.675 .735	
Apply an abstract concept or idea to a real problem		.744	
Divide problems into manageable components		.679	
Clearly describe a problem orally		.667	
Clearly describe a problem in writing		.732	
Develop several methods to solve unstructured problem		.752	
Identify tasks needed to solve an unstructured problem		.584	
Visualize what the product of a design project would look		.623	
Weight the pros and cons of possible solutions to a problem			
Understanding what engineers do			.754
Understanding language of design			.721
Understanding engineering has a non-technical side			.710
Understanding of the process of design			.703
Internal Consistency Reliability (Alpha)	.926	.943	.813

4. Does knowledge of effective instruction promotes change?

Almost forty years of research has taught us that active teaching practices, problem-based teaching, instructor's interaction and feedback, class discussion and group participation are not only preferred by students but are strongly linked to student development (e.g. Cabrera, Colbeck & Terenzini, Feldman & Paulsen, 1994; Hativa & Birenbaum, 2000; Murray, 1990). The same research shows that lecturing from class notes is not only disliked the most by students (Hativa & Birenbaum, 2000), but correlates negatively with teaching effectiveness (Murray, 1990). In light of this research one would expect innovative teaching techniques to rule the landscape of pedagogical practices in the US. Judging by the results of national faculty surveys, the ninth lesson we have learned is that few full-time faculty use innovative teaching methods. Based on a 1993 national representative sample of full-time faculty, Leslie (1998) reported that more than two-thirds of college professors relied on lecture as their primary teaching practice (see Table 6). Few full-time faculty, if any, used active learning methods (5%) while one out of six full-time faculty relied on class discussions or seminars.

Table 6. Percentage of teaching methods employed by 1993 Full-time Faculty.

Teaching Method	Percentage used by Faculty
Lecture	69.4
Seminar or discussion	17.0
Labs or internship	8.9
Active learning	4.7

Source: Leslie (1998).

Two reasons come to mind when seeking to explain the high prevalence of lecturing among college professors: a) the nature of academic work, and b) the reward system. The use of innovative teaching techniques presumes specialized knowledge on the part of faculty that only constant training and substantial experience can provide. On the other hand, graduate education at the Ph.D. level is geared towards preparing scholars and researchers, not teachers. The message graduate education conveys is clear: research paves the way to academic success (Clark & Centra, 1985). This message is furthered strengthened by the manner in which future faculty are socialized into the academic field; namely their own professors (Clark & Corcoran, 1986), who, as we already know, prefer lecturing.

The reward system further minimizes the importance of teaching in salary and promotion decisions (Strathman, 2000). Konrad and Pfeffer (1990) found a substantial negative relationship between teaching and faculty salary when examining the 1969 Carnegie Commission on Higher Education Faculty Survey. Fairweather (1993) studied the connection between teaching, research and faculty compensation across a variety of postsecondary institutions ranging from liberal arts colleges to research universities among 8,383 full and part time faculty from 424 colleges and universities who participated in the 1987-88 National Survey of

Postsecondary Faculty. Irrespectively of institutional type, mission and academic discipline, Fairweather found that "...faculty who spend more time on research and publishing, and less time on teaching earn the most income" (p.11).

For an assistant or associate professor confronting the competing demands for research and service the message is clear: we don't train you to be a teacher, nor do we reward your commitments to demanding instructional techniques. In short, the tenth lesson we have learned is effective teaching can take place when faculty are trained in teaching and rewarded for it.

4.1. Forces of Change

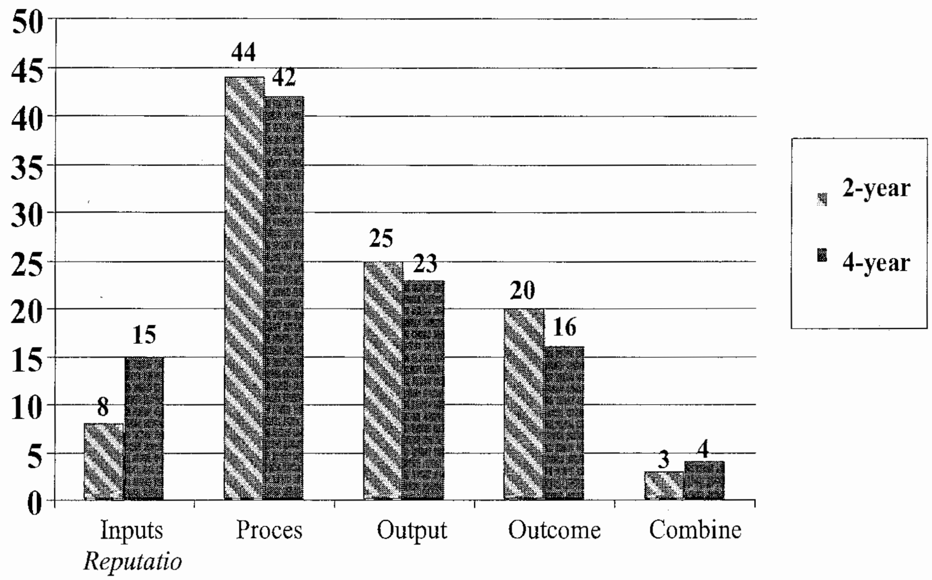
As faculty peacefully roam their classrooms regurgitating their old, yellowed and crumpled notes to sleeping classes, two major forces are hurtling towards oblivious institutions that will revolutionize the way American professors teach. Attention to outcomes and demonstrable results is playing an increasingly important role in public policy. Ewell (1998) estimates that two-thirds of the states have developed assessment mandates compelling institutions of higher education to establish mechanisms for assessing and reporting student performance. Ewell's observations regarding changes in the orientation of performance indicators in public policy seem to be confirmed by a recent study of the use of performance indicators in eleven states.

Burke and Serban (1998) found that fewer than 15% of the eleven states they surveyed used resource or reputation indexes. Instead, most of the states surveyed had introduced indicators gauging impacts or results, particularly in the area of student development and gains in professional competencies, to guide public policy (see Figure 3).

Emphasis on demonstrable changes in student outcomes is beginning to influence state-funding practices as well. Some state initiatives like the 1998 Maryland's Higher Education Reorganization Act seek institutional change by making public funding contingent upon demonstrated ability to foster student learning and to retain students. The 1998 New York Plan calls for the allocation of state funding ranging from 3% to 5% on the basis of four major groups of performance indicators: "student achievement", "faculty achievement", "academic robustness", and "quality of campus services." Though few states have adopted performance funding, Burke and Serban (1998), estimate that by the end of this century slightly more than fifty percent of the states will adopt funding schemes in which portions of state allocations to higher education institutions would be linked to demonstrated performance[1].

[1] This estimate is based on a 1997-telephone survey of all state higher education finance officers in the fifty states, Puerto Rico and the District of Columbia.

Figure 3. Use of indicators in performance funding among 11 states



Based on: Burke & Serban (1998). Performance funding for public higher education: Fad or trend?

Interest in student development is also heightened by industrial leaders' calls for college graduates who can work in teams and solve real world problems (Augustine, 1996; Black, 1994; Bucciarelli, 1988). In 1992, the National Educational Goals Panel, for instance, declared student developmental outcomes such as critical thinking, problem solving, effective communication and responsible citizenship essential when judging the effectiveness of its institutional affiliates. Accrediting agencies have contributed to this trend by shifting their focus from global resource and reputational measures to indicators of teaching effectiveness. In 1996, for example, the Middle States Association of Colleges and Schools Agency placed teaching and learning as the centerpiece in institutional self-assessment. Recently, the North Central Accreditation Commission encouraged institutional evaluators to focus their attention to students' gains in group interaction, and problem solving skills. Regional accreditation efforts are being matched by professional accrediting organizations. The Accreditation Board for Engineering and Technology (ABET), the sole agency responsible for accrediting engineering degrees in the US, recently enacted criteria requiring colleges of engineering by the year 2,001 to demonstrate their graduates have developed eleven competencies, including the abilities "to design systems or components, or process to meet desired needs", "to function on multi-disciplinary teams", and "to communicate effectively" (ABET, 1998).

5. Conclusions

Bringing a unified understanding of what effective college teaching is all about is a daunting task, quite beyond the scope of this manuscript. What we did was to attempt to derive some lesson regarding effective teaching when approached in terms of its effects on students. Using this approach, the 10 lessons we have learned can be summarized as follows:

1. Good teaching can promote student development. Instruction can bring value added to the potential the college student brings with himself or herself to the classroom.
2. Learning is a social phenomenon. Learning is the product of a complex process. The classroom climate, the student's own learning needs, goals and preferences along with teaching strategies and curriculum all interact in producing cognitive and affective development. Assessment of both learning and teaching should reflect this complexity by including a variety of assessment methods capturing the nature of the classroom interactions, teaching practices, values and performance on a series of well defined cognitive and affective domains (Astin et al., 2000).
3. Students have different ways of knowing. Classroom practices and even the curriculum itself should take into account the fact that students' way of knowing are affected by a variety of factors ranging from their preferences towards learning, their learning needs (e.g. vocational vs. academic), their gender and even their own culture.
4. College teaching is multidimensional. Teaching is complex as it embodies a wide variety of practices and methods.
5. The effectiveness of each teaching dimension varies as function of the student outcome under consideration. There is no best way to teach. Effective teaching can only take place once curricular objectives clearly specify the specific knowledge, skills and values the students are supposed to master. Only in this manner would the college professor be able to choose that pedagogy most fitting to the specific student outcome under consideration.
6. Classroom climate matters. A classroom climate dominated by prejudice and discrimination lessens learning. College professors are key in creating a nurturing environment by stressing equity and fairness in the relationships among students and between students and faculty.
7. Students can evaluate effective teaching. Students can be excellent raters of teaching performance. The key for good assessment rests on the extent to which teaching behaviors themselves are the object of assessment. This implies that institutions should spend considerable effort identifying relevant teaching behaviors and incorporating them as part of the student evaluation forms.
8. Students can evaluate their cognitive and affective growth. Again, the key in good assessment rests on content valid measures. That is, growth measures need to evolve from a deep understanding of the curricular objectives and the subject matter.

9. College professors do not use innovative teaching methods. No matter how much knowledge exists regarding effective instruction, college professors still use traditional lecturing as the main mechanism of knowledge transmission.
10. Effective teaching precludes training and rewards. Most college professors are not trained to teach, nor rewarded when they are effective. Accreditation and performance funding is creating the impetus to revisit the manner in which teaching is valued and rewarded. To the extent this *impetus* remains, we should expect major changes in the nature of the faculty work in the modern American universities.

The debate over the role of teaching was crystallized and received widespread attention in the United States through Ernest Boyer's Scholarship Reconsidered (1990). Boyer's work brought to the forefront the conflict over the role of research and teaching; the "scholarship of discovery" versus the "scholarship of teaching." Boyer argued that greater attention must me made to the scholarship of teaching to benefit not only faculty and students; simply put: "the work of the academy must relate to the world beyond the campus" (Boyer, 1990, p. 75). In closing Scholarship Reconsidered, Boyer predicted that the 1990s would witness continued exploration of the importance of teaching. The work of accrediting bodies, the assessment movement, and research on teaching has helped confirm his prediction. The ten lessons summarized in this manuscript reveal much of the progress made within American higher education since Boyer's calls for reform.

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