We Know What to Do - Why so Little Change?

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We Know What to Do – Why so Little Change?

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1. Introduction – The Challenge of Change

Despite 20+ years of theoretical and empirical research indicating the positive learning effects of research-based, student-centered teaching practices, the fraction of instructors employing "extensive lecturing" in the United States has remained relatively stable over the past decade (Hurtado, Eagan, Pryor, Whang, and Tran, 2012), a result largely mirrored in economics (Watts and Becker, 2008; Watts and Schauer, 2011). However, compared to many other fields, including those in science, technology, engineering, and math (STEM), economists' self-reported use of traditional lectures is significantly higher. The question raised here is: Why – despite a deep and growing body of evidence positively linking use of research-based pedagogical practices and student learning – don't more faculty members, especially in economics, adopt such teaching practices in their classes? As it turns out, economists have been asking this same question since at least the mid-1990s (see, for example, Becker and Watts, 1996).

Since 2000 the National Science Foundation has funded more than $5 million of pedagogical innovation projects in economics, with the aim of improving student learning. What has been the return, discipline-wide, on these educational investments? In particular, how have these investments changed teaching practices in the discipline (at both four-year and two-year institutions), especially in introductory-level courses that enroll the largest number of students? At the level of individual instructors, the focus of most economic education research to date, pedagogical innovation is difficult to implement, sustain and broaden. As a result, the overall disciplinary impact has been modest at best.

Nearly everyone who has advocated for pedagogical innovation at the department, school, or institution level (in economics or more broadly) shares a common experience: faculty resistance to change, even when substantial evidence exists to support such change. Why this resistance to change? Answering this question is important if discipline-based education research is to make significant progress improving student learning outcomes, especially in courses with high student failure rates, including introductory economics. This paper explores some possible answers, making use of cognitive science research on resistance to change (an application of behavioral economics) and empirical research on the diffusion of pedagogical innovation in economics and STEM disciplines.

Finally, given faculty resistance to change, what is the best way to promote research-based teaching practices within a discipline (or within an institution)? Should efforts focus on individuals, departments, or the discipline as a whole? What does the literature have to say about these questions?

2. Imperatives for Change – And the Challenge of Improving Teaching

At the heart of all initiatives promoting pedagogical innovation is the desire to improve student learning outcomes. Advocacy for change has come at both the national and discipline level.

Concerns About the Quality of U.S. Higher Education and Quantity of College Graduates

Over the past decade a variety of authors (see, for example, Declining by Degrees (Hersh and Merrow, 2005), Our Underachieving Colleges: A Candid Look at How Much Students Learn and Why They Should Be Learning More (Bok, 2006), Academically Adrift: Limited Learning on
College Campuses (Arum & Roksa, 2011)) have called into question the level of student learning achieved by college graduates in the U.S., especially in the areas of critical thinking and analytical reasoning.

At the same time, in recent years there have been national calls for significantly increasing the number of college graduates in the United States, with a target of eight million additional new associate and bachelor's degrees awarded by 2020. As noted by President Barack Obama in July, 2009, “... In an increasingly competitive world economy, America’s economic strength depends upon the education and skills of its workers. In the coming years, jobs requiring at least an associate degree are projected to grow twice as fast as those requiring no college experience.” [Online: http://www.whitehouse.gov/the_press_office/Excerpts-of-the-Presidents-remarks-in-Warren-Michigan-and-fact-sheet-on-the-American-Graduation-Initiative]

The president's national college graduation goal has been framed both in terms of improving international competitiveness and reducing domestic income disparities:

While the United States ranks ninth in the world in the proportion of young adults enrolled in college, we've fallen to 16th in the world in our share of certificates and degrees awarded to adults ages 25-34 – lagging behind Korea, Canada, Japan and other nations. We also suffer from a college attainment gap, as high school graduates from the wealthiest families in our nation are almost certain to continue on to higher education, while just over half of our high school graduates in the poorest quarter of families attend college. And while more than half of college students graduate within six years, the completion rate for low-income students is around 25 percent. [Online: http://www.whitehouse.gov/issues/education/higher-education]

As both Bok (2006) and Arum and Roksa (2011) argue, U.S. universities are underperforming, maintaining a learning environment that neither promotes nor requires the best efforts of our students. One cause for this shortfall, they note, is the neglect of research on teaching and learning by faculty members and departments. To meet national higher education targets, however, will likely require broader implementation of research-based teaching practices that have been shown to improve student learning in multiple educational settings.

Preparing Global Citizens in the Twenty-first Century

Accompanying the recent national initiatives from the White House for increasing both the quality of higher education and the quantity of college-educated citizens is a decade-long effort by the Association of American Colleges and Universities (AAC&U) to promote a small set of broad liberal education outcomes as the foundation for a well-educated, academically competitive, twenty-first century global citizen. The most recent efforts by the AAC&U began with the publication of Greater Expectations: A New Vision for Learning as a Nation Goes to College (2002) and have continued with the development and assessment of “essential learning outcomes” for college graduates (AAC&U, 2002 and AAC&U, 2007).

While the AAC&U's efforts first focused on a common set of student learning outcomes, recent efforts have promoted widespread implementation of empirically validated “high-impact practices” that promote the development of those outcomes (Kuh and Schneider, 2008). Among these high-impact practices: first-year seminars, learning communities, service
learning, undergraduate research, and capstone courses/projects. What distinguishes these teaching/learning practices from traditional lecture-based learning is that they induce students to “invest time and effort in their learning, interact with faculty and peers about substantive matters, experience diversity, respond to more frequent feedback, reflect on and integrate their learning, and discover the relevance of learning through real-world applications.” (Brownell and Swanson, 2010, p. xi) In particular, they require new ways of teaching that facilitate student engagement in the learning process rather than the transmission of content.

**Increasing Science, Technology, Engineering, and Math (STEM) Graduates**

As noted in a recent report, “Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics (STEM),” (President’s Council of Advisors on Science and Technology (PCAST), 2012), the challenge of increasing graduation rates is particularly important for STEM disciplines. Economic projections suggest that in order for the U.S. “to retain its historical preeminence in science and technology… (it) will need to increase the number of students who receive undergraduate STEM degrees by about 34% annually over current rates” (p. i) In order to accomplish this goal, the PCAST report explicitly cites the importance of adopting research-based teaching practices:

Better teaching methods are needed by university faculty to make courses more inspiring, provide more help to students facing mathematical challenges, and to create an atmosphere of a community of STEM learners. Traditional teaching methods have trained many STEM professionals, including most of the current STEM workforce. But a large and growing body of research indicates that STEM education can be substantially improved through a diversification of teaching methods. These data show that evidence-based teaching methods are more effective in reaching all students – especially the “underrepresented majority” – the women and members of minority groups who now constitute approximately 70% of college students while being underrepresented among students who receive undergraduate STEM degrees (approximately 45%). (p. i)

The PCAST report specifically focuses on improved teaching and learning in the first two years’ of undergraduates’ college careers, recommending “widespread adoption of empirically validated teaching practices,” including use of peer instruction, one-minute papers, group tests, concept mapping, computer simulations and games, and various forms of group learning (see Table 2, p. 17). The National Research Council’s (2012) report, *Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering*, echoes the PCAST call for improved teaching in STEM disciplines, citing the contributions made by discipline-based educational research (DBER).

STEM education leaders, such as Nobel Prize-winning physicist Carl Wieman (who served as the associate director for science in the White House Office of Science and Technology Policy from September, 2010 to June, 2012), have made similar appeals for taking a scientific approach to teaching, noting the documented shortcomings of traditional lecture methods, including low student retention of course material, persistent misconceptions regarding disciplinary concepts, and continued novice-like disciplinary beliefs (e.g. conceptual vs. algorithmic understanding) (Wieman, 2007). In fact, as Handelsman, et. al. (2004) previously pointed out, calls for “scientific teaching” promoting the use of “systematically tested” active-learning strategies were raised more than twenty years ago in the STEM community. A recent
article by Wieman (2012) (and echoed in Mervis (2013)) sums up the argument for pedagogical change: We have “an extensive body of research on how learning is accomplished, with clear implications for what constitutes effective STEM teaching and how that differs from typical current teaching at the K-12 and college levels.” (Wieman, 2012, p. 1).

However, as a recent National Science Foundation program solicitation (National Science Foundation, 2013) makes clear:

> Despite myriad advances in STEM teaching and learning know-how, it is the sense of policy makers and practitioners (and evident in accounts published in academic journals) that highly effective teaching and learning practices are still not in widespread use in most institutions of higher education. (p. 8)

Although some teaching innovations such as the SCALE-UP model (Gaffney, Richards, Kustusch, Ding and Beichner, 2008) or Peer Instruction (Mazur, 1997) in physics have spread beyond the institutions where they were initially developed, the traditional lecture approach remains the dominant model for STEM education at the undergraduate level. The 2010-2011 HERI Faculty Survey (Hurtado, Eagan, Pryor, Whang, and Tran, 2012, p. 8) indicates that approximately 62% of faculty members in STEM fields report the use of “extensive lecturing” in all or most of the courses they teach, compared to 36% in all other fields.

The Situation in Economics

While much of the push for pedagogical innovation in the U.S. is focused on improving STEM education, similar appeals have been made in economics over the past two decades. As Becker and Watts (1995) note, economists have been developing alternatives to traditional lecture in undergraduate economics instruction since the early 1970s, although the pace of innovation appears to have accelerated in the 1980s and 1990s. Becker and Watts' primary argument at the time for wider use of these innovations in economics focused on enrollment trends. According to Becker and Watts, economists

> ... should consider using a variety of teaching methods to actively engage our students and reduce the amount of time we spend lecturing to audiences that are often captive in the short run, but all to willing and able to vote with their feet in the long run, as recent enrollment trends in economics documented by Siegfried and Scott (1994) have shown... (p. 6)

Following up on this work, Becker and Watts released the results of the first national survey on teaching undergraduate economics at the AEA meetings in January 1996. The key result: “...the dominant profile of the U.S. undergraduate economics teacher is a male (83 percent), Caucasian (89 percent), Ph.D. (86 percent) ... who lectures to a class of students as he writes text, equations, and graphs on the chalkboard, and who assigns students readings from a standard textbook.” (Becker and Watts, 1996, p. 450) Becker and Watts again appealed to falling enrollments in economics as a lever for pedagogical innovation: “If falling enrollments lead to smaller economics departments, adopting new teaching methods may finally prove to be in economists' self-interest, and more attractive than other strategies to maintain enrollments...” (p. 452).

The national survey on teaching undergraduate economics has been repeated every five years since 1995, with only modest changes observed in the teaching practices of the median
economics instructor over the past fifteen years. This despite a significant increase in economic education publications discussing alternative teaching methods in undergraduate courses and an increase in the number of sessions devoted to teaching economics at the ASSA meetings (Becker and Watts, 2001, p. 446) since the mid and late-1990s. Comparing teaching practices in economics with those in other disciplines after the 2000 national survey, Becker and Watts (2001, p. 450) note that “In contrast to the passive learning environment that characterizes the teaching of economics, class discussion and other forms of active learning, rather than extensive lecturing, are now the dominant forms of instruction in other fields of education (Linda Sax et al., 1996, p. 13)” outside of STEM.

Following the 2005 national survey, Watts and Becker (2008) expressed mild hope that things would change in the future, despite little change in the median reported use of traditional lecturing in undergraduate economics course:

There are now some signs of slow change in the classroom, especially in areas in which younger economists are more likely to know and use new technologies or research methods (for example, Internet data searches, computer displays and presentations, and experimental economics). These changes in technology, research fields, and methods, in combination with the current rate of retirement among academic economists, seem likely to support more gradual changes in future years. However, we hasten to add that educators and researchers should not underestimate the strength of the inertial forces leading most economists to use chalk and talk teaching methods. (p. 285)

The 2010 national survey revealed little change, with chalk and talk remaining the dominant teaching style (with the median response of 83% remaining unchanged over the 1995-2010 period) and no perceptible movement in the median or mean responses on the use of student-student or instructor-student discussion or cooperative learning/small-group activities over the 2000-2010 decade (Watts and Schaur, 2011, p. 300). Still, Watts and Schaur remained guardedly hopeful:

Some - not many, really - new instructional methods are slowly being adopted by economists, however. In some cases that appears to happen because of newer technologies, such as PowerPoint, and wider availability of classroom projector systems. But it is also possible that some of the changes are being driven by younger faculty cohorts joining the profession; or perhaps by more emphasis on teaching by colleges, universities, and their broader constituencies; and, at the margin, perhaps even in response to calls for more use of student-centered pedagogies, and increasing numbers of conferences, training programs, and print and electronic materials on those methods. (However)... the larger and more powerful part of the picture to report is still that the preferences, incentives, and constraints that lead most economists to use “chalk and talk” teaching methods should not be underestimated. (p. 307)

In *Educating Economists* (Colander and McGoldrick, 2009), a Teagle-funded project discussing the economics undergraduate major (with particular focus on research liberal arts schools), Mike Watts notes in the preface (with a bevy of disclaimers) that among the points of agreement for project participants was the following:
Economics instruction for liberal education, and for that matter all other kinds of education, could be improved by training economists to use more innovative, student-centered teaching methods, either as graduate students or as new faculty members. (p. xxiii)

In the same volume, Simkins and Maier (2009) go further, arguing that "well-designed pedagogical innovations can have a significant impact on the type of student learning that occurs in the economics major. Further, we believe that these changes in student learning are likely to narrow the gap between 21st-century liberal education goals and those undergirding the curricula of most undergraduate economics majors." (p. 83) In particular, they highlight pedagogical innovations grounded in learning sciences and physics education research that promote expert-like learning, uncover and address student preconceptions, and develop reflective learning among students. Maier, McGoldrick, and Simkins (2012) further support expansion of these types of pedagogical innovations, noting that:

Over time, we envision movement away from the current expedient, model-oriented, analytical, and lecture-based teaching approach, toward a pedagogy that more fully engages students to think like economists. Only then will students be able to address the multifaceted, interdisciplinary, and global challenges they are likely to face in their lifetimes. (p. 107)

Summary. In spite of a deep and broad literature base in both the learning sciences (e.g. How People Learn, Bransford, Brown, and Cocking, 1999) and discipline-based educational research (e.g. physics education research and economic education research) pointing to significant benefits of non-lecture-based teaching practices in promoting student learning, as well as numerous calls for changes in teaching practices, the adoption of research-based teaching practices remains stubbornly low in economics and most STEM disciplines. The rest of the paper explores explanations for why this might be the case and what can be done about it.

3. Characterizing Faculty Resistance to Change

Faculty Resistance to Change - An Economic Perspective

Economics is fundamentally about decision-making and choice, so it seems natural to analyze the decision to adopt a pedagogical innovation (or not) through the lens of economic analysis, in particular the rational choice theory that has undergirded traditional economic analysis and instruction for the last century. In the standard framework, rational decision makers undertake an activity - in this case, adopting a new, research-based teaching practice - if and only if the overall marginal benefit (MB) of doing so outweighs the overall marginal cost (MC). The marginal costs of adopting a new pedagogical practice (in particular time and effort spent in understanding the pedagogy and revising teaching strategies) are both immediate and largely known. However, the marginal benefits (improved student learning, greater student engagement in the learning process, and perhaps greater teaching enjoyment) are in the future and uncertain. Because we don’t know whether a pedagogical innovation improved student learning, enjoyment in the course, or overall engagement until after the course is complete, the benefits of pedagogical innovation are not immediate. In addition, even if the pedagogical innovation has previously been shown to be effective at improving student learning, whether those results will transfer to my discipline, my
institution, my students, and my classroom is uncertain at the time of the decision. As a result, the marginal benefit becomes a discounted, expected marginal benefit.

With the (majority of) additional costs of adopting a pedagogical innovation front-end loaded and the additional benefits both uncertain and in the future, we can already see why getting instructors to change teaching practices is difficult; the deck is stacked against change. From this perspective, we can understand Becker’s (2001) statement: “It is also possible that the refusal to use alternative teaching methods reflects an equilibrium in which teaching efficiency, if not effectiveness, has been achieved.” (p. 278) Perhaps economists are simply optimizing in their teaching, research, leisure tradeoff, rather than maximizing the learning of their students. If marginal benefits are measured in terms of end-of-semester student evaluations of instruction, rather then improved student learning, Becker suggests, this equilibrium is further tilted toward the status quo. Becker cites work by William McKeachie (1997, p. 1219) indicating the preferences of students for passive lecture over active learning teaching methods to support his claim.

The decision-making process gets more complicated – and skewed more severely toward the “no change” outcome – when viewed through the lenses of cognitive psychology and behavioral economics. In particular, Tagg (2012) draws on the concepts of loss aversion, prospect theory, the endowment effect, and the status quo bias to illustrate why faculty members, on average, resist pedagogical change. As research by Thaler (1980), Kahneman and Tversky (1979) and others suggest, actual human decisions often do not follow the traditional rational choice model laid out by economists.1 In particular, “Most people view risky situations through a decidedly imperfect lens, with a powerful bias that causes them to take much greater risks to avoid a loss than to achieve a gain.” (Tagg, p. 10)

For most faculty members, Tagg asserts, tenure and research publications are highly-valued “endowments” that are more closely linked to research time than teaching. If the endowment effect is correct, faculty members will tend to avoid activities (such as time spent on pedagogical innovation) that threaten the tenure process, research time, and publications, even if the pedagogical innovation holds the promise of improved student learning outcomes. The departmental structure of most higher education institutions further adds to the status quo bias. Within departments, individual faculty members generally have a great deal of autonomy, which itself becomes an endowment. Classrooms become private spaces, controlled by individual faculty members. In this environment, calls for pedagogical change are viewed as a threat to their autonomy (an endowment loss), which faculty members actively resist. As a result:

The structure of faculty work virtually assures that proposals to significantly improve teaching and learning will appear to threaten important faculty endowments: research time, recognition for hard-earned expertise, the privacy of teaching, the security of tenure, the predictability of promotion and perquisites, the safety of the status quo. Most faculty, when they hear of proposals for serious educational change, fear loss, even if they cannot articulate exactly what they

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1 McFadden (2013) provides a comprehensive overview of this “new science of pleasure” and notes: “There are now extensive experiments and insights from cognitive psychology that contradict a narrowly defined neoclassical model of rational choice, many originally conducted by Amos Tversky and Danny Kahneman.” (p. 26) Among the concepts McFadden highlights as challenging the neoclassical model: the endowment effect, a “consumer aversion to trade from any given status quo.”
might lose. And because they are, after all, highly educated and articulate, they will need to resolve the cognitive dissonance, to rationalize the fear by providing arguments against or distractions from the proposals. (p. 13)

Seen in this light, faculty resistance to pedagogical change is a natural human response to the threat of endowment loss, which is magnified by the organizational and reward structure in higher education. This psychological loss adds to the direct time cost involved in making a pedagogical change and further reduces the chance that faculty members will move from the status quo.

Empirically, what explanations can be found for the ongoing prevalence of lecture in introductory economics courses? Goffe and Kauper (2012) report the results of a brief survey completed by 275 economists at the 2012 Allied Social Science Association annual meeting in January, 2012. Overall, after accounting for a wide variety of individual and institutional factors, including instructor beliefs about optimal teaching practices and the costs of moving to non-lecture teaching alternatives, Goffe and Kauper note that “there are relatively few variables associated with teaching with alternatives (to lecture). The ones that stand out are TTP training, believing in alternatives, and perhaps teaching at a bachelors-level institution.” (p. 8)

Previously, in a 2009 survey (see Maier, McGoldrick, and Simkins, 2009) associated with their Starting Point: Teaching and Learning Economics National Science Foundation project, Maier, McGoldrick, and Simkins found broad use of traditional lecture in principles-level courses (consistent with national surveys in economics), although 20% of the survey respondents reported that they were dissatisfied with this teaching practice. Many of the respondents reported being familiar with a number of listed pedagogical innovations, but relatively few of the respondents were using them. Why? "Nearly 40% of survey respondents believe that significant barriers exist for economists to integrate alternative pedagogies into their classrooms. Most frequently cited among those barriers was the opportunity cost of time to learn and adopt new teaching practices.” (p. 13)

Faculty Resistance to Change - Lessons from STEM Disciplines (With a Focus on Physics)

The situation is much the same in STEM disciplines. Since the mid-1990s physics education researchers Charles Henderson and Melissa Dancy have systematically explored the pedagogical practices and causes of instructional change among physics faculty. Many of their findings apply to other STEM disciplines as well, as underscored in a recent report from the National Research Council, Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering (National Research Council, 2012). The following quote from Henderson and Dancy (2011), nicely summarizes the current situation in STEM disciplines:

The biggest barrier to improving undergraduate STEM education is not that we lack knowledge about effective teaching. The biggest barrier to improving undergraduate STEM education is that we lack knowledge about how to effectively spread the use of currently available and tested research-based instructional ideas and strategies. (p. 1)

2 Charles Henderson’s web site includes more than 30 publications since 2006 on this subject. See: http://homepages.wmich.edu/~chenders/Publications/Publications.htm.
A recently-released publication by the National Research Council (2013) underscores this point. The report outlines a wide variety of research-based, student-focused pedagogical innovations developed in physics over the past thirty years. Physics is arguably the disciplinary leader in understanding how students learn their subject matter and intentionally developing curricula, teaching methods, and tools to address gaps in student learning. There are a variety of physics education research groups (PERGs) around the country, typically offering PhDs in the field and systematically researching specific areas of student learning in physics. Yet, despite this extensive research effort:

...evidence indicates that the physics community remains in a traditional mode where the primary purpose of physics education is to create clones of the physics faculty. ...Over the past several decades, active research by physicists into the teaching of their subject has yielded important insights about what can be done to heighten the quality of students' understanding of their universe, at all levels. But this new knowledge is slow to find significant adoption... (p. vi, National Research Council, 2013)

What keeps promising teaching ideas and strategies from being implemented and spread throughout a discipline? Henderson and Dancy (2009, 2010) report the results from a survey completed by 722 physics faculty (response rate of 50%) that while faculty are often aware of research-based teaching practices and express interest in using them, a variety of individual “situational factors” often retard their use, or continuance of their use once tried (Henderson and Dancy, 2007): expected loss of content coverage, lack of time, departmental norms, student resistance, and class size/layout. Faculty members who do try out a new research-based teaching strategy often adapt that strategy to fit within their current teaching practice, often leaving out key features that contribute to their effectiveness. As a result, some faculty members discontinue use of the new teaching strategy, concluding that it was ineffective, rather than that they were implementing it incorrectly or incompletely.

Henderson and Dancy find that among those who tried a new teaching practice for at least one semester:

...the reported rate of dropping (it) ranged from 30 to 80 percent, depending on the practice, with an overall average of 40 to 50 percent... Henderson and Dancy suggest that the high level of discontinuance (even after modification) indicates that faculty either lacked the knowledge needed to customize a research-based practice to their local situation or underestimated the factors that tend to work against the use of innovative instructional practices. (National Research Council, 2012, p. 168)

These results point out the difficulty of moving a pedagogical innovation beyond the original developer, no matter how successful at improving student learning the innovation was at the institution(s) where it was first implemented and assessed. Typically, individual (or small groups of) pedagogical innovators secure grants through national organizations such as the National Science Foundation (see, for example the Transforming Undergraduate Education in STEM (TUES) program) to develop, implement, and assess a particular teaching innovation, disseminating results through conference presentations, workshops, and publications. This “development and dissemination” approach relies on a small number of “change agents” to influence teaching practices across a discipline. While this strategy has increased awareness
it has not been effective at widely changing teaching practices, as noted above. "This is not surprising since the model implicitly assumes that knowledge and interest are sufficient for change." (Henderson and Dancy, 2011) To be effective, Henderson and Dancy argue, pedagogical reform efforts must involve faculty as meaningful participants and address not only individual instructors’ conceptions about instructional practice, but also “situational factors” like those noted above.

4. What Can/Should be Done to Broaden and Sustain Teaching Reforms?

Taking a look at work done in STEM disciplines, notably physics, again provides some useful insights related to the question of the slow diffusion of pedagogical innovation and what can be done to promote broader adoption of research-based teaching practices. For example, a recent issue of Science (April 19, 2013) included a special section on “Grand Challenges in Science Education,” led by an article highlighting Carl Wieman's nationally-recognized work (along with others) over the past 15 years promoting research-based teaching practices. In his work, Wieman has targeted academic departments, which “define the reward structure for faculty members through their authority to hire, promote, and grant tenure. ... (therefore) the best way to sustain improvements in teaching and learning is to get departments to buy into the need to change the courses that they offer.” (Mervis, 2013, p. 293)

Previously, Wieman, Perkins, and Gilbert (2010) outlined their department-focused approach for promoting the adoption and assessment of evidence-based teaching methods as a “rewarding scholarly activity” at the University of Colorado and the University of British Columbia, two large, research-intensive institutions, noting that:

The department is the unit at research universities that decides what is taught and how it is taught in that discipline; thus any sustained attempts to change teaching practices must focus on the culture of the department. To change that culture, one must affect most undergraduate courses and involve most faculty members. Science departments at large research universities are substantial entities, with dozens of tenure-track faculty, numerous non-tenure-track instructors, and budgets of up to tens of millions of dollars per year. The scale of the change effort must be consistent with this size. (p. XX)

This type of approach is consistent with the behavioral economics framework outlined above, which focuses on faculty members’ “endowment effect” and loss aversion as key elements retarding broad uptake of research-based teaching practices. As Tagg (2012) notes, the institutional structure of colleges and universities exacerbatess these effects by privileging disciplinary research over teaching (or research on teaching and learning) and promoting a culture where teaching practices (and student learning outcomes) are not seriously examined. However, as Dan Ariely makes clear (2008), a “predictably irrational” outcome like that outlined in this paper – We know what to do to improve student learning in our courses, but as a group we continue to do what is expedient, lecture – is not fate. “Once we understand when and where we may make erroneous decisions, we can try to be more vigilant (or) force ourselves to think differently about these decisions...” (p. 244) In addition, we can develop policies, practices, and procedures that mitigate the loss aversion associated with adoption of research-based teaching practices.

Tagg (2012, pp. 14-15) provides some suggestions for “reconfiguring the endowment” that faculty members face in their departments and institutions to promote greater change in
teaching and learning:

- Stop creating anti-change endowments by increasing the value of teaching, learning, and systematic pedagogical innovation, relative to research.
- Link faculty endowments to collaborative work instead of only to individual work. The former is critical to broad changes in teaching practices (say, for example, in large multi-section introductory-level courses).
- Create structures through which large numbers of faculty can design the change. Change is more likely if faculty members are engaged in designing the change and rewarded for this work.
- Establish channels outside of academic departments through which faculty members can build their endowments. Multi-department or campus-wide initiatives are more likely to gain traction than individual projects.

In the end, Tagg notes that “Faculty will not beat a path to the doors of those with the best arguments. We need to not only design change for our institutions but (also) redesign our institutions for change.” (p. 15)

That is also the message underlying the work of Beach, Henderson, and Finkelstein (2012) exploring effective strategies for facilitating change in undergraduate STEM education. Again, their insights are applicable across a wide range of disciplines, including economics. The framework they provide for understanding instructional change is drawn from extensive (Henderson, Beach, and Finkelstein, 2011) research reviewing the literature on promoting change in instructional practices in undergraduate STEM courses and provides guidance for expanding adoption of research-based teaching practices. Their framework defines four categories of change strategies, as illustrated in the 2x2 matrix in Figure 1 below (taken from Beach, Henderson, and Finkelstein, 2012). The strategies focus on both the unit of change (environments and structures vs. individuals) and the type of change (prescribed vs. emergent), yielding four distinct categories of change strategies.

Figure 1

<table>
<thead>
<tr>
<th>Category</th>
<th>Prescribed</th>
<th>Emergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Disseminating: CURRICULA &amp; PEDAGOGY</td>
<td>Goal: Teach individuals about new teaching conceptions and/or practices. 30% of articles</td>
<td>Goal: Encourage individuals to develop new teaching conceptions and/or practices. 34% of articles</td>
</tr>
<tr>
<td>II. Developing: REFLECTIVE TEACHERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. Enacting: POLICY</td>
<td>Goal: Create environments/structures that require new teaching conceptions and/or practices. 28% of articles</td>
<td>Goal: Empower stakeholders to collectively develop new environments/structures that support new teaching conceptions and/or practices. 8% of articles</td>
</tr>
<tr>
<td>IV. Developing: SHARED VISION</td>
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Their literature review (including 191 articles published between 1995 and 2008) indicates that published scholarship is evenly dispersed among three of the four categories of change strategies, with relatively less published research in the shared vision category (cell IV). While the latter category would appear to be the most effective at promoting broad changes in teaching practices, given the discussion on loss aversion above (it addresses
environments/structures that retard change while promoting collective, rather than individual, understanding and action), the authors note that:

... a successful change strategy should allow for a mixture of emergent and prescribed outcomes and pay attention to multiple levels of context, from the individual faculty to the environments and structures within which faculty work. We believe that the most successful work on instructional improvement will emerge from multi-category, multi-disciplinary, multi-institutional, and multinational research and experimentation. (pp. 58-59)

That is, to be successful at promoting broad changes in teaching practices (across course sections, a department, or a university), change strategies must extend beyond the individual instructor (changing perceptions about teaching, e.g.) to include changes in the teaching environment (including policies, reward structures, and classroom (re)design, e.g.). In addition, successful change strategies must promote communal ownership of the reasons for change (shared faculty recognition of a problem and commitment to a solution, e.g.) and strategies for addressing the environment and structure of the change (course redesign, faculty learning communities, pedagogical innovation, e.g.).

The National Research Council’s Committee on the Status, Contributions, and Future Directions of Discipline-Based Education Research (National Research Council, 2012) reached similar conclusions. While previous initiatives, such as the National Science Foundation’s Transforming Undergraduate Education in STEM (TUES) program, have focused largely on funding individual “change agents” in disciplines, including economics:

Different strategies are needed to more effectively translate findings from discipline based educational research (DBER) into practice. These efforts are more likely to succeed if they are consistent with research on motivating adult learners, include a deliberate focus on changing faculty conceptions about teaching and learning, recognize the cultural and organizational norms of the department and institution, and work to address those norms that pose barriers to change in teaching practice. (National Research Council, 2012, p. 3)

Such broad-based strategies are also consistent with a behavioral economics approach to faculty member decision-making with respect to pedagogical change. Rather than simply comparing the private marginal costs and (expected) marginal benefits of such a decision, faculty members are subject to irrational psychological endowment and loss aversion effects.

The Beach, Henderson, and Finkelstein framework helps to explain the limited impact of even large-scale pedagogical change initiatives in economics, including the Teaching Innovations Program (TIP) (Walstad and Salemi, 2011) and the Starting Point: Teaching and Learning Economics project (Maier, McGoldrick, and Simkins, 2012), two recent National Science Foundation-funded projects promoting adoption of research-based, active-student-learning teaching practices. The latter project takes a largely traditional approach to dissemination, using a web-based portal, conference presentations and publications to encourage adoption of lecture-alternatives, while the former included both a workshop and mentoring approach to promote similar goals. While the TIP program included an important post-workshop mentoring/support component, both programs are primarily located in Beach, Henderson, and Finkelstein’s quadrant II in Figure 1. Such initiatives are important for promoting and sustaining pedagogical change one-by-one, with the hope that program participants will
become change agents in their own departments. However, as Henderson and Dancy's work in physics points out, sustaining change in teaching practices even for individual faculty members is difficult, much less having these faculty members convince other faculty members in their departments to follow suit.

Recognizing the challenges in achieving widespread pedagogical change within and across disciplines, and following up on the recommendations of the Report of the President's Council of Advisors on Science and Technology (PCAST, 2012) and the National Academies’ Discipline-Based Education Research (DBER) report, Understanding and Improving Learning in Undergraduate Science and Engineering (National Research Council, 2012), the National Science Foundation recently announced a new $20 million funding program, Widening Implementation & Demonstration of Evidence-Based Reforms (WIDER), to "transform institutions of higher education into supportive environments for STEM faculty members to substantially increase their use of evidence-based teaching and learning practices." (p. 1, National Science Foundation, 2013) This type of program, which is also open to economics faculty, more fully addresses all of the quadrants in the Beach, Henderson, and Finkelstein framework, with the goal of “increasing substantially the scale of (evidence-based teaching and learning practices) within and across the higher education sector.” (National Science Foundation, 2013)

5. Summary

Two broad questions were raised in the opening section:

- Despite broad and deep evidence supporting pedagogical change away from lecture-based methods to increase student learning, engagement, and persistence, there has been relatively little change in teaching methods in economics or STEM disciplines over the past thirty years. Why so little change?
- Given what appears to be persistent and widespread faculty resistance to change, what is the best way to promote greater adoption of research-based teaching practices (within a discipline or within an institution)?

What have we concluded? In the end, it is really difficult to get people to change. Most faculty members need some type of motivation to change in the first place (a crisis helps, like declining enrollment in economics in the mid-90s or concerns about the future competitiveness of the U.S. economy today), as well as evidence that new, innovative teaching practices actually increase student learning. But we know that individual interest and data are not enough to create and sustain pedagogical change on a wide scale. As Henderson and Dancy's multi-year work in physics has shown, the process of promoting change, especially when focused on individuals, is challenging because the pipeline from familiarity to experimentation to sustained use is quite leaky. Initiatives focused on changing individual faculty members' perceptions and behaviors related to teaching and learning are particularly inefficient. One possible exception: graduate school programs aimed at making future faculty members aware of research-based teaching practices, an approach promoted by Colander and McGoldrick (2009) and Maier, McGoldrick, and Simkins (2012).

Most promising are change initiatives that address not only individual barriers to change, including loss aversion and endowment effects, but also the teaching and learning environment in institutions. Only when institutions, schools and colleges, and departments collectively address issues of teaching and learning through changes in reward structures
that change the academic endowment associated with pedagogical innovation will broad change occur. External pressures for accountability, as well as national goals of increasing college graduates, especially in STEM disciplines, may provide a catalyst for such change, but ultimately it is a matter of institutional will, a point recently reinforced by Mervis (2013). Failure to exercise institutional commitment to improved teaching and learning (across multiple universities, especially large research universities) will result in only incremental and scattered changes in teaching practices, rather then the type of transformational change sought by national and discipline-based calls for action.

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