The Faculty Role and Institutional Performance in STEM Degree Attainment

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Introduction

A great deal of national interest has focused on improving STEM teaching in colleges and universities in order to accelerate the production of the next generation of scientists, which in turn, will allow the U.S. to remain internationally competitive in research excellence (PCAST, 2012). However, the prevailing thought in academia is that highly productive scholars are not typically master teachers who use evidence-based teaching practices. Yet, Elsen and colleagues (2009) found that students benefited from learning environments where faculty were allowed the flexibility to structure their own classes and to use pedagogy that supported a tight linkage between teaching and research. Although several studies have suggested little or no correlation between effective teaching and standard measures of research productivity (Hattie & Marsh, 1996), distinguished HHMI professors have contested that there can be synergy to increase the effectiveness of both (Anderson et al., 2011). Jones (2013) offered a counter narrative to the dominant discourse about teaching and research by instead focusing on the nexus between the two. Her conceptual framework, Scholarship Teaching Action Research (STAR), posits that the underlying tension within the discourse around teaching and research is structural, as research and teaching are commonly placed on opposite ends of a continuum. She offers three ways to conceptualize the link between research and teaching, which we draw on for the studies in this report. There may well be a link between excellent teaching and research at institutions with higher levels of STEM degree productivity, but we have little knowledge about these conditions across campus contexts. We investigated this phenomenon on a national level in order to identify the conditions, contexts, and faculty practices associated with STEM degree production.

This report builds on faculty data obtained from national surveys and institutionally-reported data on degree production as required by the U.S. Department of Education. In 2013-14, the Higher Education Research Institute, UCLA administered the national faculty survey and invited institutions across the country to assess faculty work/life on their campuses. We added questions associated with undergraduate teaching and assessment to the survey, targeting campuses that varied according to STEM degree productivity (described in the next section) with the support from HHMI (Grant #52008003**)** and NIH (5R01GM071968-12). Our goal was to investigate the role of faculty in student talent development and conditions where it is synonymous with excellence in research. This is particularly important when identifying institutions that have the potential to diversify the STEM workforce.

Organization of the Report

This report highlights key findings from analyses that addressed three central questions:

1. What are the characteristics, beliefs, and teaching practices of STEM faculty nationally, and are the faculty at exemplar institutions unique in any way?
2. What is the relationship between use of evidence-based teaching practice, undergraduate engagement in research, and faculty research productivity in these high producers of STEM degrees? What kinds of institutions may improve their degree productivity with investment in any of these areas?

3. What is the faculty profile at institutions that are more efficient in producing degrees among women and URMs in STEM?

We provide analyses and results to answer each of these questions using national data to compare faculty beliefs and practices across institutional contexts by degree productivity. In addition, we compared 39 institutions that have received HHMI funding within the last two rounds of awards with 226 institutions who had not received funding during this time frame. Specifically, an HHMI institution is one that is a 4-year college that won HHMI funding in 2012 or 2008 or a university that won HHMI funding in 2010 or 2014. This was conducted in response to Question 1 and similar analyses were conducted to compare faculty at institutions with higher degree productivity for Black, Latina/o and Women across institution types for Question 3. *(Full tables are available in the Appendices).* Question 2 reexamines the structural relationships between student-centered teaching practices, scholarly productivity, and a new measure of nexus that integrates discipline-based research practices in course assignments for students. The results begin to indicate the conditions under which there is a positive relationship between teaching and research, which hold true regardless of gender, rank, and teaching load.

Research Method

Data Source and Sample

Data from this study come from the Higher Education Research Institute's (HERI) 2013-2014 Faculty Survey, which gathers information on the teaching, research, and service practices of faculty, their perceptions of campus and departmental climates, goals related to undergraduate education, and their personal values. HERI employed a stratified institutional sampling scheme for the faculty survey to ensure representation that reflects all nonprofit, postsecondary institutions. Before sampling occurred, four-year colleges and universities identified as part of the national population were divided into 20 stratification groups based on type (four-year college, university), control (public, private nonsectarian, Roman Catholic, other religious), and selectivity in admissions defined as the median SAT Verbal and Math scores (or ACT composite score) of first-time, first-year students. The methodology for the surveys is described in two reports on nationally normed data by institution type, gender, and rank (Hurtado et al., 2012; DeAngelo et al., 2009).

HERI invited campuses to participate in the faculty survey and provided them with guidelines for survey administration; the survey instrument was then administered via the internet. In cases, where institutional stratification cells were insufficient for drawing conclusions, they supplemented the sample by identifying faculty at those institutions and sending surveys to augment the sample. Funding from the National Institutes of Health and Howard Hughes Medical Institute allowed for a supplemental sample of STEM faculty to participate in the survey. The full national report, survey instrument, and methods are detailed in Appendix A of the publicly released monograph: http://heri.ucla.edu/monographs/HERI-FAC2014-monograph.pdf .

In addition, we conducted an econometric technique known as stochastic frontier analysis to analyze the efficiency with which U.S. colleges and universities produce baccalaureate and doctoral degrees in STEM, inclusive of women and underrepresented minority (URM) groups. The benefits of this technique are that, rather than identifying institutions that are simply doing

better than average (typical in a regression analysis), we identified exemplar institutions (i.e. institutions that are doing much better in producing STEM bachelor's degrees than predicted given their resources) to examine the technologies and efficiencies that exist in the production process. This allows for a comparison of institutions against peers who have similar characteristics (e.g. resources, mission). Having completed this analysis with the support of another funding agency, we proceeded to target the faculty survey to institutions that are exemplars among peers in terms of overall STEM graduate and undergraduate degree production. A second tier of institutions were also targeted, because they indicate promise in improving their degree production. In other words, these campuses would benefit most from benchmarking practices and using the survey to identify areas for faculty development and support. A similar analysis was undertaken to target institutions that are more efficient at producing women, Black, and Latina/o STEM graduates and show promise of diversifying the scientific workforce.

For this report to HHMI, efficiency scores for all institutions were merged with faculty data from participants in the 2013-14 Faculty Survey, resulting in a national sample of 5,956 STEM faculty across 265 institutions. With respect to the faculty demographics of the STEM faculty sampled, 35.0% were full professors, another 26.6% were associate professors, and 25.6% were assistant professors, and 12.9% were adjunct professors. Men were more highly represented in the sample (55.6%) than women (44.4%). Further, 5.4% of the faculty identified as coming from underrepresented racial/ethnic background. With respect to discipline, 4.2% were in agriculture or forestry, 21.2% in the biological sciences, 9.4% in engineering, 23.8% in a health-related field, 13.7% in mathematics or statistics, 20.2% in the physical sciences, and 7.4% were in a technical-related field.

Notably, of the STEM faculty included in this study, 40% were employed at research universities, 34.3% at master's comprehensive universities, and the final 25.7% employed at liberal arts institutions. Finally 41.3% of faculty surveyed were from public universities. In terms of the 262 institutions that were represented in the survey, a majority were private institutions (67.9%) with the other 32.1% being public. Further, 35.8% of the institutions surveyed were liberal arts institutions, another 44.7% were master's comprehensive universities, and the last 19.5% were research universities. Although institutions ranged in size from as little as 396 students enrolled to many as 53.5 thousand, the average size – as measured by the full-time student equivalent for fall enrollment− was 7,129 students.

Analysis

Several types of analyses were conducted to answer the research questions driving this report. To address research questions one and three, we conducted descriptive statistics to examine if faculty beliefs and practices significantly differed across different types of institutions when survey responses were aggregated. Specifically, institutional comparisons were made between responses from faculty at HHMI institutions and those at non-HHMI institutions. Further, responses from faculty at what we define as high-efficiency institutions were compared to those at medium-efficiency institutions and those at low-efficiency schools. Significance tests were conducted to determine whether the percentage of faculty having a specific response to selected survey items across different types of institutions were significant, taking into account sample size differences.

To address research question two, we examine the interrelationships between scholarly research productivity, teaching (i.e. the use of student-centered pedagogy), and research-teaching

nexus (which measures teaching practices that integrate discipline-based research into the classroom) among STEM faculty members who taught at what we defined as "highly efficient institutions". Faculty working at institutions considered to be "highly efficient" were those who taught at institutions that fell half a standard deviation or more *above* the mean for STEM efficiency scores among all institutions in our national sample. Structural equation modeling (SEM) allowed for the estimation of the interrelationships among the three latent constructs and the three control variables, accounting for measurement error (Bentler, 2005; Bentler & Wu, 2002). SEM was useful in that it provided coefficients that estimated the statistical significance and magnitude of the relationships between the three theoretical constructs (i.e., *research-teaching nexus*, *scholarly productivity*, and *student-centered pedagogy*).

Mplus 7.4 was the primary statistical software package used to test the validity of the hypothesized models and illustrates via both numerical output and picture diagrams the interrelationships between the exogenous variables and endogenous constructs. After testing for the non-normality of the data, and determining that the data were within the range of multivariate normality (Boomsma & Hoogland, 2001; Muthén & Kaplan, 1985; West et al., 1995), we proceeded to use FIML as the estimator during analysis.

Building the final hypothesized SEM model occurred in a series of steps. First, we tested for the validity of the three latent constructs using confirmatory factor analysis in MPlus. Second, we created a structural model beginning with correlation model between *scholarly productivity* and *student-centered pedagogy* to determine the baseline relationship between the two constructs. Next, we developed the structural model with the hypothesized paths (without the controls) to determine the relationships between the three latent constructs and to determine if *research-teaching nexus* changed the relationship between *scholarly productivity* and *student-centered teaching*. The final SEM model included the three latent constructs and the three control variables.

We used goodness-of -fit indices to determine the adequacy of the SEM models (Laird, Engberg, & Hurtado, 2005). Several fit indices were used to assess model fit during confirmatory factor analysis and structural equation modeling, which included the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR).

Invariance Tests. We followed Byrne's (2012) sequence of steps for determining whether or not components of the measurement and structural models were invariant (i.e., equivalent) across faculty employed at different institutions (liberal arts, master's comprehensive, and research institutions). In particular, we were interested in determining whether the covariance between *scholarly productivity* and *student-centered pedagogy* in our specified SEM model containing controls was equivalent across faculty teaching at different institutional types. In testing for invariance, equality constraints are imposed on particular parameters making it necessary for the data for all groups to be analyzed simultaneously to obtain efficient estimates (Bentler, 2005; Jöreskog & Sörbom, 1996). The model under test in this multigroup application is the same postulated three-factor structure in the SEM model containing controls that was created for the entire faculty sample. Further it is important to note that we knew *a priori* that although the originally hypothesized factor structure for each group is similar, it is not identical as faculty employed in different contexts had slightly different baseline models. By implementing a condition of partial measurement invariance, we continued with the multigroup analysis.

Linear regression analysis was also performed in order to determine the faculty demographic characteristics, institutional characteristics, faculty opinions and perceptions, faculty behaviors, and approaches to teaching and goals for student outcomes that are predictive of more frequent use of integrating discipline-based research assignments as a teaching tool in classes (i.e what we term research-teaching nexus).

Variables

For a list of the variables we used in the analyses, please refer to Appendix A. See Appendix B for descriptive statistics (mean, minimum score, maximum score, etc.) of all the variables.

Main Findings

Section 1. Key Features of Faculty at Institutions with High Efficiency in All STEM Degree Productivity and HHMI Institutions

Each of these sections begins to address the corresponding research question (i.e. Question 1). We examined survey responses focusing on institutional differences by comparing national data on HHMI funded institutions (and those that are not funded by HHMI), and institutions with low, medium and high efficiency scores in STEM degree production among undergraduate students. We compared the frequency of individual faculty responses by the comparison groups of interest and tested significance levels, accounting for sample size differences. (See Table 1 for detailed frequencies of each item by institutional group). The following findings were prevalent for all STEM degree recipients: (Corresponding findings for Women, Black and Latina/o efficiency scores are in Section III of this report)

- Faculty at the most efficient STEM producing institutions were significantly more likely to have worked with undergraduates on research, engaged them in their own research projects, and presented at conferences or published with undergraduates.
- Similar to the most efficient STEM degree producers, faculty at HHMI-funded institutions were more likely to have included undergraduates on research in some capacity.
- There were large differences in faculty research productivity: The majority of faculty at high efficiency institutions were more likely to have tangible research outputs (e.g. published articles, chapters) compared with faculty at low and medium efficiency institutions. Similarly, the majority of faculty at HHMI-funded institutions (79.4%) were productive in terms of publications compared with those at non-HHMI institutions (58.0%) in the last two years.
- Although the majority of STEM faculty use a variety of grading practices, faculty at both the most efficient STEM producers (29%) and HHMI-funded institutions (34%) were significantly more likely to grade on a curve in “most” or “all” of their courses compared with low-efficiency and non-funded campuses.
- Traditional teaching practices still prevail among faculty, especially at many highly efficient and HHMI-funded institutions. There were only a few notable exceptions in which a significantly greater proportion of faculty at these institutions engaged in a ‘best

practice in teaching' compared to their counterparts at comparison institutions: Giving assignments that require students to employ research methods from their discipline in field and applied settings, and assignments where students deeply engage with a significant challenge or question in their respective discipline.

- In general, low efficiency institutions were more likely to use real-life problems as a method of teaching, utilize rubric-based assessments when assigning grades to students, and believe that all students have the capacity to succeed in their classrooms. Only a quarter of faculty from low efficiency institution use technology that allows students to "learn before lecture" and this was significantly higher than faculty at high efficiency institutions (19%).

We conclude that faculty at highly efficient STEM institutions engage students in research and are also more likely to be highly productive research scholars. Some of latest innovations in teaching are still not widespread, though it appears that less efficient institutions are more likely to be attentive to teaching and to employ a variety of techniques that may improve their degree production. Slightly different results are reported in section III in examining institutional efficiency in underrepresented groups' STEM degree production.

Specific Findings: All STEM Degree Recipients, Differences by Efficiency Scores

Pedagogical Practices of Faculty. The analysis revealed a number of pedagogical practices that differ among faculty employed at colleges and universities categorized as high, medium, and low efficiency institutions. Indeed, in creating assignments for courses within the last year, there are a number of practices that a greater proportion of faculty at high efficiency institutions did "frequently" compared to their colleagues at low and medium efficiency institutions, and this was expected. For example, a higher proportion of faculty at high efficiency institutions (47.4%) report "frequently" giving students assignments that require students to deeply engage with a significant challenge or question within their respective discipline compared to faculty at medium efficiency institutions (42.4%, $p < .05$). Furthermore, more faculty at high efficiency institutions (49.8%) relative to faculty at medium efficiency institutions (43.8%, $p < .01$) report that assignments "frequently" required students to employ research methods from their discipline in field or applied settings.

However, there were findings that may suggest that faculty are working hard to help improve learning at institutions with lower efficiency scores. For example, a higher proportion of faculty in the low efficiency group (91.3%) report that they "frequently" provide instructions clearly delineating what students are to do to complete an assignment, compared to their counterparts in the high efficiency group (87.3%, $p < .01$). Additionally, more faculty in the low efficiency group (64.4%) reported that they "frequently" explicitly linked assignments with course goals or learning objectives, compared to faculty in the high efficiency group (59.4%, $p < .05$). With respect to applying learning from both academic and field settings, faculty at low efficiency institutions (49.4%) reported "frequently" giving students assignments that required them to engage in this practice compared to their colleagues at high efficiency institutions (40.7%, $p < .01$). Additionally, a greater proportion of faculty at low efficiency institutions (29.7%) reported that their assignments "frequently" require students to describe how different perspectives could affect the interpretation of a question or issue in their discipline compared to faculty at high efficiency institutions (25.5%, $p < .05$).

Classroom practices reflect differences in teaching approaches among the low, medium, and high efficiency institutions as well, but also reveal that a majority of faculty stick to traditional teaching practices. Although the majority of faculty are not "grading on curve" in most of their classes, a greater proportion of faculty at high efficiency institutions (29.0%) reported grading on a curve in "most" or "all" of their courses, compared to a lower proportion of faculty at both medium efficiency institutions (24.1%, $p < .01$) and low efficiency institutions (19.0%, $p < .01$). Following this trend, a greater percentage of faculty at low efficiency institutions (58.8%, $p < .01$) and medium efficiency institutions (52.1%, $p < .05$) report employing rubric based assessment for "most" or "all" of their courses, compared to faculty at high efficiency institutions (46.9%). Furthermore, more faculty at low efficiency institutions (73.6%) utilized class discussion for "most" or "all" of their courses, compared to the percentage of faculty at high efficiency institutions (68.0%, $p < .01$).

Concerning, experiential learning/ field studies, faculty at low efficiency institutions (35.2%) reported engaging in this practice when teaching in "most" or "all" of their courses compared to faculty at high efficiency institutions (29.5%, $p < .01$). Furthermore, more faculty at low efficiency institutions (41.2%) report that they use performances or demonstrations as a teaching tool in "most" or "all" of their courses, compared to the percentage of faculty at high efficiency institutions (30.0%, $p < .01$). Faculty at low efficiency institutions also reported higher rates of employing reflective writing or journal in "most" or "all" of their courses (22.1%), compared to faculty at high efficiency institutions (13.7%, $p < .01$). Likewise, more faculty at low efficiency institutions (84.7%, $p < .01$) and medium efficiency institutions (75.0%, $p < .01$) reported utilizing real-life problems as a pedagogical tool in "most" or "all" of their courses compared to the percentage of faculty at high efficiency institutions (69.2%).

Faculty at low efficiency institutions were also more likely to use student inquiry to drive learning in "most" or "all" of their courses (60.6%) compared to faculty at high efficiency (49.8%, $p < .01$). Moreover, more faculty at the low efficiency institutions (25.6%) employed "learn before lecture" through multimedia tools in "most" or "all" of their courses, compared to faculty at high efficiency institutions (19.4%, $p < .01$). Still it should be noted, that the majority of faculty are not using "learn before lecture" teaching techniques, which are a typical feature of "flipped" classrooms. Concerning techniques to create an inclusive classroom environment for diverse students, faculty at low efficiency institutions (50.0%) report a higher rate of using this practice in "most" or "all" of their courses, compared to the faculty at high efficiency institutions (40.7%, $p < .01$). Finally, a higher proportion of faculty at low efficiency institutions (62.9%) "strongly agreed" with the perception that all students in their classes had the potential to excel compared to faculty at "high" efficiency institutions (55.2%, $p < .01$).

Engagement in Undergraduate Research and Research Productivity. Faculty interactions with students outside of the classroom also varied across different institutional STEM efficiency groups, particularly with respect to faculty involvement in undergraduate research. A higher proportion of faculty at high efficiency institutions (68.6%) report that they have engaged undergraduates on their research projects in the past two years, compared to their faculty peers at medium efficiency institutions (62.9%, $p < .01$) and low efficiency institutions (51.8%, $p < .01$). Similarly, a higher proportion of faculty at high efficiency institutions (76.1%) report that they have worked with undergraduates on a research project in the past two years, compared to faculty at medium efficiency institutions (71.9%, $p < .05$) and low efficiency institutions (62.2%, $p < .01$). It makes sense then that a higher percentage of faculty at low

efficiency institutions (59.6%) report that they had not presented with undergraduate students at conferences at all in the past two years, compared to faculty at high efficiency institutions (53.1%, $p < .01$). Relatedly, more faculty at low efficiency institutions (71.4%, $p < .01$) and medium efficiency institutions (66.3%, $p < .01$) report that they had "not at all" published with undergraduates in the past two years, compared to faculty at high efficiency institutions (59.2%). In general, the high efficiency institutions are more likely to conduct research, present at conferences, and publish with undergraduates.

When it came to research productivity, faculty at low and medium efficiency institutions were far less likely to have tangible research outputs compared to faculty at high efficiency institutions in the past two years. Indeed 25.4% of faculty at low efficiency institutions reported no articles published in academic or professional journals in the last two years compared to only 12.0% of faculty at high efficiency institutions ($p < .01$). Further 65.5% ($p < .01$) of faculty at low efficiency institutions and 56.6% ($p < .01$) of those at medium efficiency institutions had never published a chapter in an edited volume compared with 49.8% of faculty at high efficiency institutions. Finally, 46.0% of faculty at low efficiency institutions ($p < .01$) and 34.3% of those at medium efficiency institutions ($p < .01$) reported that none of their professional writings were published or accepted for publication in the past two years, compared with only 27.5% of faculty at high efficiency institutions.

Attitudes and Beliefs of the Institution, Institutional Support, and Stressors. Concerning faculty members' perceptions of the institution, a greater proportion of faculty at low efficiency institutions (64.8%, $p < .01$) and medium efficiency institutions (64.9%, $p < .01$) "strongly" or "somewhat" agreed that their institution takes responsibility for educating underprepared students, compared to the faculty in high efficiency institutions (58.7%).

With respect to significant sources of faculty career stress, the saliency of stressors differed for faculty at institutions categorized within different efficiency score groups. For example, 39.0% faculty at high efficiency institutions report that committee work was "not at all" a source of stress in the past two years, compared to only 34.2% ($p < .05$) of faculty at low efficiency institutions. Furthermore, more faculty at low efficiency institutions (18.1%) report that their teaching load "extensively " contributed to their stress during the past two years, compared to faculty at high efficiency institutions (14.2%, $p < .05$). Indeed a much greater proportion of faculty at low efficiency institutions teach five or more courses compared to faculty at high efficiency institutions (12% versus 5%, $p < .01$). Alternatively a far higher proportion of faculty at high efficiency institutions teach between zero to two courses a term (64.3%) compared to faculty at low (43.3%, $p < .01$) and medium (59.4%, $p < .05$) efficiency institutions. This may help explain why a greater percentage of faculty at high efficiency institutions reported fewer hours per week preparing for teaching (including reading student papers and grading), compared to faculty at low efficiency institutions.

Departing from the trend above, a greater proportion of faculty at low efficiency institutions (27.5%) report that a lack of personal time was "not at all" a source of stress in their lives in the past two years, compared to faculty at high efficiency institutions (23.1%, $p < .05$). In a similar vein, a higher percentage of faculty at high efficiency institutions (36.8%) report that self-imposed high expectations contributed extensively to their stress, compared to faculty at low efficiency institutions (29.0%, $p < .01$). Finally, faculty at low efficiency institutions (64.3%) report a higher rate of participating in organized activities around enhancing pedagogy and student learning, compared to faculty at high efficiency institutions (59.1%, $p < .05$).

Comparing HHMI and non-HHMI Institutions

Pedagogical Practices of Faculty. The data revealed a number of pedagogical practices that differ among faculty employed at HHMI-funded colleges and universities and their non-HHMI funded counterparts. Indeed, the frequency of giving assignments that required students to engage in a specific practice differed, though in many cases the differences were marginal (at the .05 level). As expected, a higher proportion of faculty at HHMI institutions (48.0%) reported that they "frequently" require students to engage deeply with a significant challenge or question within their respective discipline on assignments, compared to their colleagues at non-HHMI institutions (43.3%, $p < .05$). The next several findings demonstrate how faculty create assignments that guide learning. For example, a higher proportion of faculty at non-HHMI institutions (88.8%) report that they "frequently" provide instructions clearly delineating what students are to do to complete an assignment, compared to their counterparts at HHMI institutions (85.7%, $p < .05$), but it is important to note that both types engage in this activity at fairly high levels. Continuing with this trend, faculty at non-HHMI colleges and universities report that they "frequently" create assignments that require students to describe how different perspectives would affect the interpretation of a question or issue in their respective discipline at higher rates (28.1%), compared to their peers at HHMI colleges and universities (24.1%, $p < .05$). In addition, 45.6% of faculty at non-HHMI institutions report that the assignments they create "frequently" require students to apply learning from both academic and field settings, compared to only 37.6% of faculty at HHMI institutions ($p < .01$).

Classroom practices reflect differences in teaching approaches among the HHMI institutions compared to other institutions. For example, when it comes to giving grades, over a third of faculty at HHMI institutions (34.0%) report that they grade on a curve in either "most" or "all" of the classes that they teach, compared to one in five faculty at non-HHMI colleges and universities (20.4%, $p < .01$). Alternatively, faculty at non-HHMI colleges and universities (55.5%) are more likely to report that they use rubric-based assessments, in "most" or "all" the classes they teach, compared to faculty at HHMI colleges and universities (43.0%, $p < .01$). Further, the proportion of faculty reporting that they used the following teaching practices in "most" or "all" of their courses was significantly higher at non-HHMI funded institutions compared to HHMI institutions: experiential learning (33.2 versus 27.8%, $p < .01$); performances or demonstrations (37.1% versus 27.6%, $p < .01$); reflective writing and journaling (18.9% versus 11.8%, $p < .01$); student inquiry to drive learning (56.5% versus 48.0%, $p < .01$); and "learn before lecture" methods through multimedia tools (e.g., flipping the classroom) (23.2% versus 18.9%, $p < .05$).

Considering the environment for undergraduate students, more faculty at non-HHMI colleges and universities (47.6%) use techniques to create an inclusive classroom environment for diverse students in "most" or "all" of the classes they teach, compared to faculty at HHMI colleges and universities (37.7%, $p < .01$). Finally, when it came to faculty beliefs about their students, a greater proportion of faculty at non-HHMI colleges and universities (89.8%) "strongly" or "somewhat" agreed that all of the students in their courses had the potential to excel compared to faculty at HHMI institutions (87.1%, $p < .05$). However, it is important to note that faculty across both groups of institutions have fairly high levels of belief in student capacity for success.

Engagement in Undergraduate Research and Research Productivity. Faculty interactions with students outside of the classroom also varied across different campuses, particularly with respect to faculty involvement in undergraduate research. Concerning research activities with undergraduate students, more faculty at HHMI institutions (81.7%) report that they have worked with undergraduates on a research project in the past two years, compared to faculty at non-HHMI institutions (64.8%, $p < .01$). Similarly, more faculty at HHMI-funded institutions engage undergraduates in their own research projects (75.5%) than faculty at non-HHMI colleges and universities (54.9%, $p < .01$). Among the latter institutions, 60.2% faculty report that they had not presented with undergraduate students at conferences in the past two years, compared to only 50.3% of faculty at HHMI colleges and universities ($p < .01$). Furthermore, most faculty at non-HHMI colleges and universities (71.2%) report that they have not published with undergraduates, compared to faculty at HHMI colleges and universities (52.2%, $p < .01$). Thus, similar to the most efficient STEM degree producers, faculty at HHMI-funded institutions are more likely to engage undergraduates in authentic research projects, presentations, and publications.

With respect to research outputs, faculty at non-HHMI institutions were far less productive than their colleagues at HHMI funded institutions in the past two years. Indeed faculty at non-HHMI institutions were more likely to report that they had not published any articles in academic or professional journals (71.6%) compared to faculty at HHMI institutions (52.2%, $p < .01$). Faculty at non-HHMI institutions were also far more likely to report that they had not published a chapter in an edited volume (62.3%), compared to their colleagues at HHMI institutions (44.0%, $p < .01$). Finally faculty at non-HHMI institutions were also more likely to report that they had not had any professional writings published or accepted for publication in the past two years, compared to their counterparts at HHMI institutions (42.0% versus 20.6%, $p < .01$).

Attitudes and Beliefs of the Institution, Institutional Support, and Stressors. Comparative analyses revealed several differences in institutional perceptions between faculty at HHMI and non-HHMI institutions, with faculty at non-HHMI institutions perceiving their institutions more favorably. For example, faculty at non-HHMI colleges and universities (64.5%) more strongly agreed that their institution takes responsibility for educating underprepared students, compared to faculty at HHMI colleges and universities (58.1%, $p < .01$). Furthermore, faculty at non-HHMI institutions (68.4%) were more likely to report that developing a sense of community among students and faculty was either a "high priority" at their institution or their institution's "highest priority", compared to faculty at HHMI institutions (61.6%, $p < .01$).

With respect to the various sources of stress that faculty encounter, more faculty at HHMI colleges and universities (42.0%) reported that committee work was "not at all" a source of stress during the last two years, compared to the faculty at non-HHMI institutions (35.7%, $p < .01$). More faculty at non-HHMI colleges and universities (10.8%) reported that working with underprepared students was an "extensive" source of stress during the last two years, compared to faculty at HHMI colleges and universities (7.3%, $p < .01$). Further, a greater proportion of faculty at non-HHMI colleges and universities (17.2.0%) reported that their teaching load was an "extensive" source of stress during the last two years, compared to faculty at HHMI colleges and universities (11.7%, $p < .01$). Indeed a greater proportion of faculty at non-HHMI institutions (35.8%) report spending twelve or more hours a week preparing for teaching (including reading student papers and grading), compared to faculty at HHMI institutions (26.7%, $p < .01$). In a

similar vein, a significantly lower proportion of faculty at non-HHMI teach between zero and two courses during the term for which the faculty survey was taken. Indeed, only 48.2% of faculty at non-HHMI institutions taught up to two classes; in contrast 76.8% ($p < .01$) of faculty at HHMI institutions taught within that range of classes. In contrast, a greater percentage of faculty at HHMI institutions (38.2%) reported that self-imposed high expectations contributed an "extensive" amount to their stress during the last two years, compared to a lower rate of faulty at non-HHMI colleges and universities (31.6%, $p < .01$).

As it relates to professional development, more faculty at non-HHMI colleges and universities (64.3%) report that they had participated in organized activities around enhancing pedagogy and student learning as a teaching activity (compared to not doing so), compared to faculty at HHMI institutions (55.1%, $p < .01$).

Main Findings

Section II. Understanding the Interrelationship Between Scholarly Productivity and Teaching at Highly Productive STEM Institutions

In order to understand the conditions under which teaching and research may be compatible as postulated by Jones (2013), Elsen et al., (2009) and Anderson et al., (2011), we developed a model to test the relationship between specific types of teaching practices and scholarly productivity. The series of models includes three primary constructs: faculty use of student-centered pedagogy, their scholarly productivity (measured in terms of publications), and their practices that reflect the nexus between research and teaching (R-T Nexus). In addition, we held constant three faculty attributes (current teaching load, sex, and rank). Refer to Table 2 for the parameter estimates of the model.

Below are findings of the analysis of a series of nested models, using structural equation modeling.

- Similar to previous research, simple Model 1 indicated the relationship between Scholarly Productivity and Student-Centered Pedagogy in highly productive institutions is non-significant and negative.
- In Model 2, we found that both highly productive scholars and faculty who used student-centered pedagogy were significantly more likely to use practices that involved integrating research and teaching (R-T Nexus) in students' classroom assignments. Though these two relationships were highly significant, the relationship between scholarly productivity and student-centered pedagogy remained the same as in Model 1 (non-significant).
- Model 3, tested the same pattern of interrelationships as in Model 2, but included controls for teaching load, sex, and rank. Once these were taken into account, the relationship between scholarly productivity and student-centered pedagogy was positive and significant. The relationships predicting R-T Nexus remained positive and significant. These indicate conditions which have not been tested in previous research.
- Subsequently, Model 3 was tested across different institutional types: Research, Liberal Arts colleges, and Master's' Comprehensive institutions. The main relationships essentially were the same (per the invariance tests), though the characteristics of faculty

(control variables) worked differently in terms of relationships with the constructs depending on the type of college. (For more details see findings section below).

- Finally, we predicted the characteristics of faculty that used R-T nexus practices more frequently (Table 3). Confirming previous analysis with additional controls, we found that that some of the strongest predictors were faculty that used student-centered pedagogy, provided feedback on drafts that were still in progress, helped students accept mistakes as part of the learning process, explicitly linked assignments with course goals and learning objectives, and used techniques to create an inclusive classroom. Faculty in the health sciences and biological sciences were more likely than faculty in the physical sciences, engineering, or mathematics to employ R-T nexus; there were no differences with respect to faculty rank, with the exception of non-tenure track faculty who are the least likely to utilize R-T nexus. Scholarly productivity was significant but not as strong a predictor as some of these other factors.

We conclude that faculty can be both productive scholars and engaged in active learning or student-centered pedagogy. Institutions that are highly efficient in producing STEM degrees are more likely to have highly productive scholars who also use student-centered pedagogy, and use practices that combine research and teaching, when faculty characteristics are held equal (holding constant faculty sex, rank, and teaching load). The use of teaching practices and research outputs of faculty (the three constructs) can differ by faculty characteristics, and so it is important to take such demographic factors into account. Finally, the use of research in teaching is associated with a host of other practices that include students as developing scientists.

Specific Details and Findings

Jones (2013) posited a framework for re-conceptualizing the link between research and teaching, and we were able to operationalize the introduction of research methods in the classroom. In order to investigate potential areas for synergy and retest the key set of relationships between scholarly productivity and teaching, we developed a measure of how faculty integrate knowledge production with knowledge dissemination in the classroom, or the nexus of research and teaching in practice. *Research-teaching nexus* it is a five-item latent factor comprised of STEM faculty responses to the question, "how frequently in the courses you taught in the past year have you given at least one assignment that required students to..." The five items included in this factor include: "engage deeply with a significant challenge or question within your discipline," "use research methods from your discipline in field or applied settings," "apply learning from both academic and field settings," "describe how different perspectives would affect the interpretation of a question or issue in your discipline," and "weigh the meaning and significance of evidence." Participants could choose one of three response options for each item: "not at all," "occasionally," or "frequently." A higher score on research-teaching nexus indicates that the faculty member more frequently used discipline-based research assignments as a teaching tool in their classes. This became the dependent variable in the SEM model.

Scholarly productivity is indicated by three items (i.e. number of published articles in academic and professional journals, number of published chapters in edited volumes, and number of professional writings published or accepted for publication in the last two years). A higher score on *scholarly productivity* therefore indicates that the faculty member was more productive in terms of research outputs.

In examining the extent to which faculty utilized student-centered pedagogical practices within their classrooms, faculty indicated the proportion of courses they taught that they used each of the following practices: class discussions; cooperative learning (small groups); experiential learning/field studies; group projects; student-selected topics for course content; reflective writing/journaling; student inquiry to drive learning; real-life problems; and performances/demonstrations. Faculty had the option of selecting "none," "some," "most," or "all" as responses to each item. Thus a higher score on *student-centered pedagogy* therefore indicated that the faculty member used these instructional methods in a greater number of their classes.

Sample. The total sample in the "high efficiency" group included 1,825 faculty across 75 "highly productive" institutions. Within this unique sample of faculty, 5.4% identified as being from an underrepresented racial/ethnic minority background and 44.4% were women. Further 35% were full professors, 26.6% were associate professors, 25.6% were assistant professors, and the remaining 12.9% were non-tenure track faculty like instructors and lecturers. With respect to discipline, 23.8% were in a department related to the professional health sciences, 21.2% were in the biological sciences, 20.2% in the physical sciences, 9.4% were in engineering, 4.2% of the faculty were from an agriculture or forestry related department, and the remaining 7.4 % were in a department we defined as "other technical." All findings are reported using the unstandardized coefficients.

The simple relationship between scholarly productivity and student-centered teaching practices. The first of the analysis (Model 1) involved determining the baseline relationship between *scholarly productivity* and *student-centered teaching practices* using the sample of faculty that taught at what we defined as "highly efficient institutions." Findings show that the relationship between the two constructs was initially negative ($\beta = -0.040$, S.E. = 0.031, $p = 0.192$), but non-significant. In other words, without controlling for faculty characteristics, there is a zero relationship between *scholarly productivity* and use of *student-centered pedagogy* – the number of publications faculty completed in the last two years has no relationship to their use student-centered teaching practices in the classroom, which is a finding similar to that concluded by Hattie and Marsh (1996).

Adding research-teaching nexus to the model. The next step (Model 2) involved putting the three latent constructs into a model (without the controls) to determine whether *R-T Nexus practices* are associated to *Scholarly Productivity* and *Student-Centered Pedagogy*. We hypothesized that faculty who more often use student-centered pedagogy, would be more likely to utilize R-T nexus practices in their classes, so we specified a path from student-centered pedagogy predicting use of research-teaching nexus practices. Similarly, we hypothesized that those who are more productive when it comes to scholarly output, are more likely to infuse activities that involve research in class assignments as a mode of teaching, so we specified a path from scholarly productivity predicting use of R-T nexus practices. Since the directional relationship between scholarly productivity and student-centered pedagogy remains unclear, we specified a correlation between the two constructs. This correlation was of primary interest, specifically how it compares to the results in Model 1.

The latter relationship between *student-centered teaching practice*s and *scholarly productivity* remained negative ($\beta = -0.035$, S.E. = .030, $p = .246$), but non-significant. The path from *scholarly productivity* to *R-T nexus* was positive ($\beta = 0.234$, S.E. = .032, $p = .000$) and highly significant. Similarly, the path from student centered pedagogy to R-T nexus was positive ($\beta = 1.091$, S.E. = .059, $p = .000$) and also highly significant. In other words, faculty use *R-T*

nexus more often in their classrooms, when they are more productive in terms of research publication outputs and when they use *student centered pedagogy* in a greater number of the classes they teach.

*Adding the control variables to the model***.** In the final round of model building (Model 3), we added the three control variables – sex, faculty rank, and number of courses being taught the term the survey was taken – to the SEM model to determine if the introduction of controls better accounted for the relationships between the use of *student centered-pedagogy*, use of *research-teaching nexus*, and *scholarly productivity*. Of particular interest were the relationships between the three latent factors. As hypothesized, both *scholarly productivity* (β = 0.162, S.E. = .033, p = .000) and *student-centered pedagogy* (β = 1.049, S.E. = .057, p = .000) are significant positive predictors of the frequency of faculty's use class assignments that incorporate *R-T Nexus*. Further, there was a significant relationship between *scholarly productivity* and the utilization of *student-centered pedagogy*. Most importantly, we recorded a change wherein the relationship went from being non-significant in Model2, to becoming significantly positive (β = .098, S.E. = .032, p = 0.002) in Model 3, which included controls. This indicates that relationships observed in previous research may have much to do with previous constructs in the model (i.e. the survey items they used as proxies to measure the constructs of interest) and the absence of appropriate controls for teaching load, sex and rank. Moreover, institutions that are highly efficient in producing STEM degrees are more likely to have highly productive scholars that also use student-centered pedagogy when they teach, and these faculty are more likely to use practices that combine research and teaching, when faculty characteristics are held equal (holding constant sex, rank, and teaching load).

Findings across institutional types. One of the goals of this study is to determine whether the relationship between *scholarly productivity* and *student-centered teaching* varies across institutional type (i.e. liberal arts institutions, master's comprehensive institutions, and research institutions). Invariance testing revealed that the relationships between the three constructs worked in a similar way when comparing institutions of different types. The three variables for which we controlled (i.e. sex, academic rank, and number of courses they taught), however, worked a bit differently depending on the institutional type. (See Table 2 for the parameter estimates of this model).

Teaching a higher number of courses during an academic term is positively and significantly related to research-teaching nexus practices at liberal arts institutions (β = .115, S.E. = .043, p = .007) and research institutions (β = .108, S.E. = .032, p = .001), but has no effect at master's comprehensive institutions (β = .029, S.E. = .044, p = .518). In layman's terms, faculty at liberal arts institutions and research institutions more frequently integrate inquiry-based research activities within the scope of the classroom setting when they teach more classes.

Although the sex of faculty does not matter within master's comprehensive institutions (β = .011, S.E. = .130, p = .933) and liberal arts institutions (β = .185, S.E. = .106, p = .081) when it comes to the use of *R-T nexus* in teaching, it does matter at research institutions (β = .206, S.E. = .085, p = .015). At research institutions, women more frequently report using assignments that infuse *research-teaching nexus* practices than their male counterparts. Interestingly, the findings suggest no significant differences between a faculty member's rank and their use of research-teaching nexus in the classroom at liberal arts institutions (β = .033, S.E. = .050, p = .503); in other words, junior faculty (i.e. assistant professors) use research-teaching nexus practices as much as senior faculty (i.e. associate professors and full professors) at liberal arts institutions. This is not the case at Master's comprehensive institutions (β = .098, S.E. = .055, p = .075) and

research institutions (β = .121, S.E. = .041, p = .003), with more senior faculty (full professors and associate professors) using *R-T nexus* more frequently in their classrooms than lecturers and junior faculty.

With respect to *student-centered teaching* practices, findings show that at research institutions, instructors/lecturers and more junior faculty have a higher propensity of adopting practices in their classes that are known to engage students in the learning process compared to their more senior colleagues (β = -.095, S.E. = .031, p = .002). Academic rank does not appear to have a significant effect on the use of student-centered pedagogy at liberal arts institutions (β = .010, S.E. = .047, p = .829) or master's comprehensive institutions (β = - .088, S.E. = .048, p = .068). Likewise, the number of courses faculty teach during a term positively and significantly predicts the use of student-centered pedagogy in the classroom, but only at research institutions (β = .093, S.E. = .029, p = .002). In other words, the more courses a faculty teaches over the course of a term, the more they infuse student-centered pedagogy in the classes they teach. At liberal arts institutions (β = .051, S.E. = .042, p = .219) and master's comprehensive institutions (β = .028, S.E. = .042, p = .505), the number of courses taught has no bearing on the use of *student- centered teaching.* Finally, female faculty use student-centered pedagogy in a greater number of their classes than their male counterparts across all three types of institutional context (liberal arts institutions: β = .525, S.E. = .103, p = .000) (master's comprehensive institutions: β = .524, S.E. = .121, p = .000) (research institutions: β = .388, S.E. = .078, p = .000).

With respect to *scholarly productivity*, more senior faculty (i.e. full professors and associate professors) have a greater tendency to be drivers of scholarly productivity irrespective of institutional type (liberal arts institutions: β = .369, S.E. = .051, p = .000) (master's comprehensive institutions: β = .432, S.E. = .052, p = .000) (research institutions: β = .713, S.E. = .036, p = .000). It makes sense that full professors would have produced more scholarship than assistant professors and lecturers, because full professors would have likely been in academia longer and assembled research teams to be highly productive. Interestingly the number of courses taught during a given term has no effect on faculty research productivity, but only at master's comprehensive institutions (β = -.045, S.E. = .043, p = .291) and liberal arts institutions (β = -.035, S.E. = .044, p = .429). Echoing other research (Fairweather & Beach, 2002), the number of courses taught during a given term negatively impacts scholarly productively, but only at research institutions (β = -.172, S.E. = .030, p = .000). Indeed, time and energy exerted towards carrying a heavier course load must affect the time and energy available to conduct research. Confirming previous studies (Sax et al,. 2002), women tend to have lower levels of *scholarly productivity* compared to their male counterparts over the last two years, at all three institutional types (liberal arts institutions: β = -.241, S.E. = .110, p = .028) (master's comprehensive institutions: β = -.464, S.E. = .124, p = .000) (research institutions: β = -.335, S.E. = .079, p = .000).

T*he Characteristics of Faculty Who Use R-T Nexus.* Another point we sought to examine, were the predictors of faculty tendency to use research-infused assignments as a teaching tool (what we term research-teaching nexus.) Previous literature and theory guided our selection of variables for a regression model predicting use of R-T Nexus. (See Table 3. for a complete list of variables within the regression model and the corresponding variable coefficients and significance levels.) Of the items capturing a variety of faculty demographic characteristics, non-tenure track faculty members had a tendency to less frequently use assignments that infuse research into their teaching than their colleagues who were full professors; in contrast, assistant

professors and associate professors used research-teaching nexus just as frequently as full professors. Further teaching a greater number of courses was associated with more frequent use of R-T Nexus. With respect to department, faculty from agriculture or forestry, engineering, mathematics/statics, the physical sciences, and other technical departments less frequently used research-infused assignments as a teaching tool (compared to faculty in the biological sciences). Only faculty in health-related departments more frequently used R-T Nexus in their assignments (compared to faculty in the biological sciences).

Only one institutional characteristic mattered in the frequency with which faculty used research-teaching nexus: the control of the institution, with faculty at private institutions having the tendency to use R-T Nexus less frequently than those at public institutions.

With respect to faculty opinions and perceptions, greater agreement with the statement, "all students have the potential to excel in my courses," was associated with more frequent use of R-T Nexus. Further, faculty have a tendency to more frequently use R-T nexus practices in their teaching, when they apply to internal grants for research, engage students in research to a greater extent, produce more research publications, and spend a greater number of hours per week preparing for teaching (including reading student papers and grading).

Finally with respect to pedagogical practices, the following variables are associated with a tendency to more frequent use R-T Nexus in one's classroom: using student-centered pedagogy in a greater proportion of the classes one teaches; using learn-before-lecture through multimedia tools (e.g., flipping the classroom) in a greater proportion of the courses that one teaches; using techniques to create an inclusive classroom environment for diverse students in a greater proportion of the courses that one teaches; more frequently providing feedback on drafts or work still in progress; more frequently explicitly linking the assignment with course goals or learning objectives; more frequently provide instructions clearly delineating what students are to do to complete an assignment; to a greater extent structuring courses so that students master a conceptual understanding of course content; more frequently encouraging undergraduates to accept mistakes as part of the learning process; and placing a greater importance on helping students evaluate the quality and reliability of information.

Main Findings

Section III. Understanding Features of Institutions with Relatively Higher STEM Degree Productivity for Women, African American, and Latina/os

According to the higher education literature, there are several faculty and institutional practices that seem to matter in helping students learn and graduate from college in a STEM discipline. We replicated the analysis of Section I, this time using institutional efficiency scores for degree recipients in STEM who were female, Latino, and African American. Findings are then organized by thematic heading similar to Section I. Key findings highlight important differences that indicate that institutions that are more productive with underrepresented groups in STEM do not always have the same faculty practices, beliefs, and behaviors. Refer to Tables 4, 5, and 6 to see the frequency breakdowns of each variable item grouped by low, medium, and high efficiency institutions. The most important findings from Tables 4, 5, and 6 are summarized here:

- Some unique findings were evident among faculty at high efficiency institutions for women STEM degrees in the following pedagogical techniques: Asking students to apply learning from both academic and field settings, describe how different perspectives would affect the interpretation of a question, and weight the meaning and significance of evidence. Faculty at these institutions indicated that they also try to dispel perceptions of competition. There were no differences across efficiency score campuses for women STEM degrees in the use of "grading on a curve" among faculty (close to one quarter use this technique in most or all of their classes).
- It is notable that those faculty at institutions with medium STEM efficiency scores for women were significantly more likely than those at high efficiency scores to engage undergraduates in their own research and work with undergraduates on a research project. Yet, faculty at high efficiency institutions for women were more productive scholars.
- There were distinctive findings for institutions that were highly efficient in producing Latina/o STEM degree recipients compared to institutions highly efficient with all STEM students. Specifically, faculty at highly efficient institutions for Latino students were more likely to frequently link assignments with course goals in an explicit manner, more likely to use class discussions, and somewhat more likely to use student-selected topics in class (compared to their low and medium efficient institutional counterparts). Those highly efficient in Latina/o STEM producers were also more likely to engage undergraduates in research and were productive scholars. Alternatively, those faculty at low efficiency institutions were more likely to state that their institution took on the responsibility of working with underprepared students, but also reported more stress from teaching loads than those at highly efficient institutions. Institutions that were highly efficient with Latino students also shared some common results with those institutions that were highly efficient at producing STEM degrees among the total undergraduate population (irrespective of race or gender) in Section 1. Similar findings include "grading on a curve", engaging deeply in a challenge within the discipline, and using research methods of the discipline.
- Institutions highly efficient in producing African American STEM degrees have several unique features. Faculty at these institutions are more likely to provide instructions to clearly delineate what students are to do to complete assignments and explicitly link assignments with course goals. They are more likely to ask students to describe how different perspectives affect interpretation of a question in the discipline and use reflective journal writing, and are significantly more likely to report using rubric-based assessment in most or all of their classes (58.3%). It is surprising to note, however, that fewer faculty work with undergraduates in research at the highly efficient institutions compared with faculty at medium and low efficiency institutions. This finding may indicate areas for greater investment since exposure to research is essential during the undergraduate years.

We identified some areas that replicate the trends demonstrated when considering all the efficiency of institutions producing degrees among all STEM students, but also begin to suggest unique features associated with URM degree production. Clearly the faculty in the low efficiency group appear to be dealing with higher teaching loads and are responsible for educating underprepared students. On a positive note, faculty at highly efficient institutions in URM degree production also demonstrate a wider repertoire of teaching practices.

Specific Findings: STEM Efficiency Scores for Female Undergraduate Students

Pedagogical Practices of Faculty. The analysis revealed a number of pedagogical practices that differ among faculty teaching at colleges and universities categorized as high, medium, and low efficiency institutions. (See Table 4.) Indeed in creating assignments for courses within the last year, there are a number of practices that a greater proportion of faculty at high efficiency institutions did "frequently" compared to their colleagues at low efficiency institutions. (Faculty at medium efficiency institutions were similar to faculty at high efficiency institutions when it came to the nature of assignments). For instance, faculty at high efficiency institutions were more likely to report that they "frequently" provide instructions clearly delineating what students are to do to complete an assignment (89.1%) compared to their counterparts at low efficiency institutions (85.8%, $p < .05$). Faculty members at high efficiency institutions were also more likely to report that they "frequently" give at least one assignment that requires students to engage deeply with a significant challenge or question within their respective STEM discipline (47.1%) compared to their counterparts at low efficiency institutions (41.3%, $p < .05$). Continuing the trend, faculty members at high efficiency institutions were more likely to report that they "frequently" gave at least one assignment that required students to write in the specific style or format of their respective discipline (56.7 %) compared to faculty at low efficiency institutions (51.5%, $p < .05$).

Faculty members at high efficiency institutions were additionally more likely to report that in the courses they taught, they "frequently" gave assignments that required students to use research methods from their respective discipline in field or applied settings (50.3%) compared to their counterparts at low efficiency institutions (43.3%, $p < .01$). Not surprisingly, compared to faculty at low efficiency institutions, faculty members at high efficiency institutions were more likely to report that they "frequently" gave at least one assignment that required students: to apply learning from both academic and field settings (39.7% versus 46.5%, $p < .01$); to describe how different perspectives would affect the interpretations of a question or issue in their discipline (24% versus 30%, $p < .01$); and to weigh the meaning and significance of evidence (53% versus 60%, $p < .01$).

Classroom practices reflect differences in teaching approaches among the low, medium, and high efficiency institutions as well. Faculty members at low efficiency institutions were less likely to report that they used student presentations in "most" or "all" of the courses they taught (42%) compared to their counterparts at high efficiency institutions (47.8%, $p < .05$). Interestingly, faculty members at medium efficiency institutions were more likely to report that they used performances and/or demonstrations in "most" or "all" of the courses they taught (36.3%) compared to their counterparts at high efficiency institutions (31.9%, $p < .05$). Regarding faculty efforts to dispel perceptions of competition in the classroom, a greater proportion of faculty members at high efficiency institutions report that they agreed "somewhat" or "strongly" that they tried to do so (78.1 %), compared to their counterparts at low efficiency institutions (71.7%, $p < .01$).

Engagement in Undergraduate Research and Research Productivity. Faculty interactions with students outside of the classroom also varied across different institutional efficiency groups, particularly with respect to faculty involvement in undergraduate research. For instance, faculty at medium efficiency institutions (64.9%) report that they engage

undergraduates on their research project (versus not doing so) in greater proportions than their colleagues at high efficiency groups (59.9%, $p < .05$). Likewise, faculty in the medium (73.5%) efficiency institutional group work with undergraduates on a research projects (versus not doing so) at higher rates compared to faculty in the high efficiency group (67.5%, $p < .01$). As expected given the previous two findings, faculty in the high efficiency group in greater proportions report that they had not presented with undergraduate students at conferences in the last two years (59.5%), compared to colleagues in the medium efficiency group (53.6%, $p < .05$). Thus, it is not a surprise that more faculty in the medium group (11.5%) report that they publish with their undergraduates to "a great extent" compared to faculty in the high efficiency group (8.3%, $p < .05$). However, in general most faculty in both the medium (61.1%) and high (66.5%) groups do not publish with their undergraduate students at all.

With respect to research productivity, faculty at low efficiency institutions (61%) are more likely to report that they had never published a single chapter in an edited volumes compared to their colleagues in the high efficiency group (52.4%, $p < .01$). Lastly, a much higher proportion of faculty at low efficiency institutions report that none of their professional writings had been published or accepted for publication within the past two years (41.1%), compared to their counterparts in the high efficiency group (32.9%, $p < .01$).

Attitudes and Beliefs of the Institution, Institutional Support, and Stressors. Faculty at low efficiency institutions were more likely to agree "somewhat" or "strongly" (66.7 %) compared high efficiency institutions (59.3%, $p < .01$) that their institution took responsibility for educating underprepared students. Faculty at medium efficiency institutions are more likely to report that they agree "somewhat" or "strongly" that there is adequate support at their institution for faculty development (69.8 percent) compared to faculty at high efficiency institutions (57.4 percent, $p < .01$).

Our analysis also shows differences in faculty's perceptions of their respective institutions across the efficiency groups with respect to graduating female STEM undergraduate students. Curiously, a greater proportion of faculty in the medium efficiency group "strongly" or "somewhat" agree that there is adequate support for faculty development at their institution of employment (69.8%), compared to their colleagues in the high efficiency group (57.4%, $p < .01$). Furthermore, faculty in the medium efficiency group report that they have taken advantage of internal grants for research within the past two years at greater rates (41.3%) compared to their counterparts in high efficiency institutions (32.0%, $p < .01$). Only one work-related stressor manifested differently for faculty across the different institutional efficiency groupings; indeed, faculty at highly efficient institutions (36.8%) are more likely to report that working with underprepared students was not a source of stress in the past two years, compared to their counterparts in the low efficiency group (31.9%, $p < .05$). Notably a much greater proportion of faculty at high efficiency institutions teach only between zero to two courses a term (60.5%), compared to faculty at low efficiency institutions (49.8%, $p < .01$). Relatedly, a greater proportion of faculty at high efficiency institutions (18.2%) tend to spend between zero and four hours a week preparing for teaching (including reading student papers and grading) compared to faculty at low (20.0% , $p < .05$) and medium efficiency institutions (19.2%, $p < .01$). These findings were similar to those presented in Section I for the All STEM efficiency score groups.

Specific Findings: STEM Efficiency Scores for Latino Undergraduate Students

Pedagogical Practices of Faculty. The analysis revealed a number of pedagogical practices that differ among faculty employed at colleges and universities categorized as high, medium, and low efficiency institutions. (See Table 5.)Indeed in creating assignments for courses within the last year, there are a number of practices that a greater proportion of faculty at high efficiency institutions did "frequently" compared to their colleagues at low and medium efficiency institutions. For example, faculty at high efficiency institutions reported that they "frequently" linked in an explicit manner assignments with course goals or learning objectives (64.5%) compared to faculty at low efficiency institutions (58.7%, $p < .01$). The data also show that faculty at high efficiency institutions were much more likely to report that they "frequently" gave at least one assignment that required students to engage deeply with a significant challenge or question within their discipline (48.8%), compared to faculty at low efficiency institutions (40.9%, $p < .01$).

Further, faculty at high efficiency institutions were most likely to report "frequently" giving assignments that required students to use research methods from their respective discipline in field or applied settings (50.3%) compared to their counterparts at medium efficiency institutions (44.4%, $p < .05$) and faculty members at low efficiency institutions (43.9%, $p < .01$). Compared to faculty at high efficiency institutions (46.3%), those at medium efficiency institutions were less likely to report that they "frequently" gave assignments that required students to apply learning from both academic and field settings (41.4%, $p < .05$).

Classroom practices reflect differences in teaching approaches among the low, medium, and high efficiency institutions as well. Faculty at high efficiency institutions (72.5%) were more likely to report using class discussions in "most" or "all" of the classes they taught compared to faculty members at low efficiency institutions (66.3%, $p < .01$). Faculty members at high efficiency institutions were more likely to report (20.3%) using student-selected topics for course content in "most" or "all" the courses compared to faculty at low efficiency institutions (16%, $p < .05$). Faculty members at high efficiency institutions were also more likely to report that they graded on a curve for "all" or "most" of the courses they taught (28.3%) compared to their counterparts at low efficiency institutions (21.3%, $p < .01$). The latter is similar to the findings regarding all STEM efficiency scores (irrespective of students' race and gender).

Engagement in Undergraduate Research and Research Productivity. Faculty interactions with students outside of the classroom also varied across different institutional efficiency groups, particularly with respect to faculty involvement in undergraduate research. Faculty members at high efficiency institutions were significantly more likely to report that they engaged undergraduates on their research projects (65.7%), compared to faculty members at low efficiency institutions (55%, $p < .01$). Further, faculty members at high efficiency institutions were more likely to report working with undergraduates on a research project (72.1%), compared to their counterparts at low efficiency institutions (67%, $p < .05$). Given the previous two findings, it is not surprising that a greater proportion of faculty at low efficiency institutions report that they never had published with undergraduates (72.7%) compared to faculty at high efficiency institutions (59.7%, $p < .01$).

With respect to research productivity, faculty at low efficiency institutions were far more likely to report that they had not published any articles in academic or professional journals (21%, $p < .01$) compared to faculty at high efficiency institutions (13%). Faculty at low (61.6%, $p < .01$) and medium (60.6%, $p < .01$) efficiency institutions were also far more likely to report that they had not published a chapter in an edited volume, compared to their colleagues at high

efficiency institutions (49.4%). Finally faculty at low (42.3%, $p < .01$) and medium (36.2 %, $p < .01$) efficiency institutions were also more likely to report that they had not had any professional writing published or accepted for publication in the past two years, compared to their counterparts at high efficiency institutions (28.1%). Again, this pattern is consistent with the findings for degree production for All STEM groups.

Attitudes and Beliefs of the Institution, Institutional Support, and Stressors. Turning to faculty attitudes and beliefs, faculty members at low efficiency institutions were more likely to report that they agreed "somewhat" or "strongly" that their institution takes responsibility for educating underprepared students (65.5%) compared to faculty at high efficiency institutions (61%, $p < .05$). Similarly faculty members at low (67.1%, $p < .05$) and medium (69.9%, $p < .01$) efficiency institutions reported in greater proportions that they believed developing a sense of community among students and faculty was a "high priority" or the "highest priority" at their institution, compared to high efficiency institutions (62.1%).

Finally, faculty reported various sources of career stress within the past two years. As expected, a greater proportion of faculty members at low efficiency institutions reported that their teaching load was an "extensive" source of stress (17%) compared to faculty members at high efficiency institutions (13.7%, $p < .05$). Indeed a much greater proportion of faculty at high efficiency institutions teach only between zero to two courses a term (63.6%) compared to faculty at low (50.0%), $p < .01$) and medium (56.1%, $p < .01$) efficiency institutions. In a similar vein, a higher proportion of faculty at high efficiency institutions (25.4%) spend zero to four hours a week preparing for teaching (including reading student papers and grading) compared to faculty at both low (19.3%, $p < .01$) and medium (17.5%, $p < .01$) efficiency institutions. Relatedly, faculty members at high efficiency institutions are most likely to report that they are "not at all" stressed from working with underprepared students (40.3%), compared to faculty at medium efficiency institutions (34.8 %, $p < .05$) and those at low efficiency institutions (31.7%, $p < .01$).

STEM Efficiency Scores for Black Undergraduate Students

Pedagogical Practices of Faculty. The analysis revealed a number of pedagogical practices that differ among faculty employed at colleges and universities categorized as high, medium, and low efficiency institutions. (See Table 6.) Indeed in creating assignments for courses within the last year, there are a number of practices that a greater proportion of faculty at high efficiency institutions did "frequently" compared to their colleagues at low and medium efficiency institutions. For instance, a greater proportion of faculty at high efficiency institutions report that they "frequently" provide instructions clearly delineating what students are to do to complete the assignment (89.8%), compared to their counterparts in the medium efficiency group (86.6%, $p < .05$). Similarly more faculty in the high efficiency group report that they "frequently" explicitly link the assignment with course goals or learning objectives (63.5%) compared to faculty in the medium efficiency group (56.8%, $p < .01$). Further, a higher proportion of faculty in the high efficiency group reported that they "frequently" gave at least one assignment that required students to engage deeply with a significant challenge or question within their discipline (47.3%), compared to their colleagues in the medium efficiency group (42.0%, $p < .05$).

Following this trend, a lower proportion of faculty in the low (40.8%, $p < .01$) and medium (39.3%, $p < .01$) efficiency groups report that they "frequently" provide assignments that require students to apply learning from both academic and field settings, compared to their counterparts in the high efficiency group (50.0%). A higher percentage of faculty in the high efficiency group (31.1%) also report that they "frequently" assign activities that require students to consider how different perspectives would affect the interpretation of a question or issue in their discipline, compared to faculty in the low (25.7%, $p < .05$) and medium (24.2%, $p < .01$) groups.

Classroom practices reflect differences in teaching approaches among the low, medium, and high efficiency institutions as well. A greater proportion of faculty at institutions in the high efficiency group report that they use reflective journaling/writing in "all" or "most" of the classes that they teach (19.7%), compared to faculty in the medium group (14.9%, $p < .05$). With respect to evaluating students' performance, a higher proportion of faculty in the high efficiency group report that they utilize rubric-based grading on all or most of the assignments they give to students (58.3%) compared to their colleagues in the low (48.2%, $p < .01$) and medium groups (50.5%, $p < .01$).

Engagement in Undergraduate Research and Research Productivity. Faculty interactions with students outside of the classroom also varied across different institutional efficiency groups, particularly with respect to faculty involvement in undergraduate research. Curiously, a greater proportion of faculty in the low efficiency (67.1%, $p < .01$) and medium efficiency groups (60.8%, $p < .05$) report that they engage undergraduates on their research project than their colleagues in the high efficiency group (55.8%). Similarly, a greater percentage of faculty in the low (75.4%, $p < .01$) and medium efficiency groups (72.0%, $p < .01$) report that they work with undergraduates on a research project than faculty in the high efficiency group (63.5%).

Given the previous two findings regarding research with undergraduates, it was not surprising to find that a greater proportion of faculty in the high efficiency group (61.2%) report that they never had presented with undergraduate students at conferences, compared to colleagues in the low (52.2%, $p < .01$) and medium groups (56.0%, $p < .05$). Similarly, a greater proportion of faculty in the high efficiency group never had published with undergraduate students (72.1%) compared to faculty in the low (58.8%, $p < .01$) and medium groups (65.9%, $p < .01$). This pattern is counter to the pattern in other groups where high efficiency institutions conduct more research with undergraduates.

When it came to research productivity, a greater proportion of faculty at medium efficiency institutions (60.7%, $p < .05$) reported that they had not published any chapters in an edited volume compared to their colleagues in the high group (55.7%). There were no other significant differences in research productivity across the efficiency comparison groups.

Attitudes and Beliefs of the Institution, Institutional Support, and Stressors. With respect to institutional support, more faculty in the low efficiency group agree "strongly" or "somewhat" that there is adequate support for faculty development at their college or university (67.1%, $p < .01$), compared to 59.6% of faculty in high efficiency institutions. Furthermore, a higher proportion of faculty in the low efficiency group (41.0%, $p < .01$) reported that they indeed took advantage of internal grants aimed to support professional development within the past two years, compared to their counterparts in the high group (31.5%). Lastly, working with

underprepared students didn't seem to be as much of a stressor to faculty at low efficiency institutions with 40.1% reporting that such students were never a source of stress, compared 33.4% of faculty at high efficiency schools ($p < .01$). Notably a much greater proportion of faculty at low efficiency institutions teach only between zero to two courses a term (60.2%) compared to faculty at high efficiency institutions (54.9%, $p < .05$). Relatedly, a greater proportion of faculty at high efficiency institutions tend to spend between zero and four hours a week preparing for teaching (including reading student papers and grading) compared to faculty at medium efficiency institutions (23.2% versus 18.2%, $p < .05$).

Concluding Discussion

This set of studies begins to unpack the link between research and teaching with additional complexity. Instead of teaching and research being at odds, this research shows that they can work in unison to elevate both the research production and engaged teaching of faculty. These findings support previous work wherein faculty who more frequently use student-centered teaching practices were also the same people to more frequently engage undergraduate students in research (Elsen et al., 2009). Our findings contrast with the work of other scholars that found no relationship between scholarly productivity and the frequency with which an instructor uses student-centered pedagogy (Braxton, 1996; Feldman, 1987; Milem, Berger, & Dey, 2000; Hattie & Marsh, 1996) – the differences in findings may be due to the fact that we analyzed only the behavior of faculty at institutions that were "highly efficient" at producing STEM bachelor degrees among their undergraduate students. Another distinction of these analyses is that we captured new measures of introducing discipline-based research practices that are linked with research excellence and student-centered teaching, a relatively new practice gaining momentum across many STEM disciplines (Singer et al., 2012). Moreover, we show that there can be greater synergy between research and teaching as faculty in research universities engage in inquiry-based, student-centered teaching.

To dispel the prevailing notion that engaged, student-centered teaching equates to being a less productive researcher, faculty and the administration need to identify examples of the synergy that can be created between research and teaching. In other words, STEM faculty need to see positive role-models of 'synergy' and 'nexus practices' so that faculty can re-imagine what is possible as teachers and researchers. Institutions also need to do a better job of supporting the professional development of faculty when it comes to using research-based instructional strategies and giving them time to revise courses and practice these strategies. Indeed, in a study that examined the relationship between knowledge of research-based instructional strategies and implementation of such practices among a national sample of faculty teaching introductory physics classes, 12% of faculty reported having no knowledge of any research-based instructional strategies and only 16% were aware of these instructional practices, but had not tried any (Henderson, Dancy, & Niewiadomska-Bugaj, 2012). Another 23% of faculty had stopped using research-based instructional strategies after a period of initially trying them out. Clearly additional efforts must be made to support faculty in their implementation of inquiry-based research activities in the classroom, so that faculty are aware of the essential features of these instructional methods, have realistic expectations of student learning gains, and become knowledgeable of the core issues (including potential problems) related to using these practices. In order to encourage academics to take advantage of these professional development

opportunities, reward policies and promotional considerations must value research-teaching nexus practices (Elsen et al., 2009).

Research inherently has a dual role in the academic enterprise: it is both a tool that enhances the learning environment and also is an integral piece of the educational process itself (Simons & Elen, 2007). In this way the relationship between teaching and research ought to more appropriately be conceptualized as being fluid and bi-directional and necessary to help students ask new questions to advance research. A fluid relationship is necessary because 21st century problems require that students not only have acquired the requisite knowledge in the discipline, but also that students possess metacognitive skills whereby they know how to find, assess, and apply information (Biggs, 2003). In this way graduates of STEM programs become knowledge creators and critically contribute to solving rapidly changing national and global problems in science.

Further research is needed to understand those institutions that are highly productive in STEM production (relative to resources), and we have embarked on a series of qualitative case studies to help us understand the extent to which institutions are engaged in broader transformation. Most disturbing among our findings is that those institutions that are highly productive in African American STEM degree holders appear not to be engaging undergraduates in their research as much as other institutions. Because of the importance of this experience, it suggests a disparity that will manifest itself in access to graduate school and STEM careers after college. Additional investment in those institutions to ensure students are receiving quality STEM experiences may be necessary in the future. For example, NIH has funded cross-institutional partnerships at 10 institutions to foster and improve research opportunities as students obtain their undergraduate degree. Indeed, while institutions are efficient in the use of resources for degree production, they may still require some resource-intensive experiences to better position their graduates for STEM careers.

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Table 1. Descriptive Statistics for All STEM Efficiency Percentages Distributed by Group for Variables of Interest

		National Sample (N=265 Institutions; 5952 faculty)		Non-HHMI Institutions (N=226; 4370 faculty)		HHMI Institutions (N= 39 Institutions; 1586 faculty)		Sig diff	"Low" Efficiency Institutions (N=73 Institutions; 1522 faculty)			"Medium" Efficiency Institutions (N=90 Institutions; 2125 faculty)			"High" Efficiency Institutions (N=75 Institutions; 1825 faculty)			
		Count	Column Valid N %	Count	Column Valid N %	Count	Column Valid N %		Count	Column Valid N %	Mean Score	Count	Column Valid N %	Mean Score	Count	Column Valid N %	Mean Score	Significant Differences Between Efficiency Groups
Provide instructions clearly delineating what students are to do to complete the assignment	1 Not at All	88	1.6%	60	1.4%	27	2.0%		9	.6%		42	2.2%		28	1.6%		
	2 Occasionally	585	10.4%	417	9.8%	168	12.3%		122	8.1%	2.91	216	11.3%	2.84	193	11.1%	2.86	
	3 Frequently	4942	88.0%	3768	88.8%	1171	85.7%	*	1369	91.3%		1652	86.5%		1518	87.3%		**Low/High
Explicitly link the assignment with course goals or learning objectives	1 Not at All	419	7.5%	315	7.4%	102	7.5%		90	6.0%		175	9.2%		125	7.2%		
	2 Occasionally	1789	31.9%	1323	31.2%	466	34.2%		442	29.6%	2.58	647	34.0%	2.48	579	33.4%	2.52	
	3 Frequently	3392	60.6%	2596	61.3%	796	58.4%		963	64.4%		1083	56.9%		1031	59.4%		*Low/High
Engage deeply with a significant challenge or question within your discipline	1 Not at All	766	13.7%	598	14.1%	167	12.3%		209	14.0%		285	14.9%		220	12.7%		
	2 Occasionally	2347	41.9%	1803	42.6%	542	39.8%		617	41.3%	2.31	813	42.6%	2.27	693	39.9%	2.35	
	3 Frequently	2489	44.4%	1835	43.3%	654	48.0%	*	667	44.7%		809	42.4%		824	47.4%		*Med/High
Write in the specific style or format of your discipline	1 Not at All	821	14.7%	612	14.5%	208	15.2%		214	14.4%		272	14.3%		246	14.2%		
	2 Occasionally	1766	31.6%	1350	32.0%	416	30.5%		458	30.8%	2.40	623	32.7%	2.39	529	30.4%	2.41	
	3 Frequently	3004	53.7%	2263	53.6%	740	54.3%		816	54.8%		1009	53.0%		963	55.4%		
Use research methods from your discipline in field or applied settings	1 Not at All	1020	18.2%	782	18.5%	237	17.4%		284	19.1%		348	18.3%		293	16.8%		
	2 Occasionally	1986	35.5%	1529	36.2%	456	33.4%		523	35.1%	2.27	722	37.9%	2.25	580	33.4%	2.33	
	3 Frequently	2589	46.3%	1918	45.4%	671	49.2%		683	45.8%		833	43.8%		866	49.8%		**Med/High
Apply learning from both academic and field settings	1 Not at All	1290	23.1%	892	21.1%	396	29.2%		288	19.3%		481	25.3%		441	25.4%		
	2 Occasionally	1859	33.3%	1409	33.3%	450	33.2%		466	31.3%	2.30	650	34.2%	2.15	587	33.9%	2.15	
	3 Frequently	2437	43.6%	1927	45.6%	510	37.6%	**	736	49.4%		770	40.5%		705	40.7%		**Low/High
Describe how different perspectives would affect the interpretation of a question or issue in your discipline	1 Not at All	1663	29.8%	1207	28.6%	454	33.4%		413	27.7%		612	32.3%		533	30.7%		
	2 Occasionally	2407	43.1%	1830	43.3%	577	42.5%		635	42.6%	2.02	797	42.0%	1.93	760	43.8%	1.95	
	3 Frequently	1516	27.1%	1187	28.1%	328	24.1%	*	443	29.7%		488	25.7%		443	25.5%		*Low/High
Use research methods from your discipline in field or applied settings	1 Not at All	670	12.0%	490	11.6%	179	13.1%		166	11.1%		253	13.3%		199	11.5%		
	2 Occasionally	1772	31.6%	1366	32.3%	406	29.8%		495	33.2%	2.45	607	31.8%	2.42	518	29.8%	2.47	
	3 Frequently	3158	56.4%	2379	56.2%	777	57.0%		830	55.7%		1046	54.9%		1020	58.7%		
Provide feedback on drafts or work still in progress	1 Not at All	783	14.0%	568	13.4%	214	15.7%		201	13.4%		273	14.3%		248	14.3%		
	2 Occasionally	2726	48.7%	2069	48.9%	656	48.1%		710	47.5%	2.26	950	49.9%	2.21	846	48.7%	2.23	
	3 Frequently	2091	37.3%	1597	37.7%	494	36.2%		584	39.1%		681	35.8%		643	37.0%		
Grading on a curve	1 None	2968	53.7%	2366	56.6%	601	44.6%		866	58.9%		1013	53.9%		811	47.2%		
	2 Some	1251	22.6%	961	23.0%	289	21.4%		325	22.1%		415	22.1%		408	23.8%		
	3 Most	658	11.9%	460	11.0%	198	14.7%		153	10.4%	1.69	218	11.6%	1.83	229	13.3%	1.97	
	4 All	652	11.8%	391	9.4%	261	19.3%		127	8.6%		235	12.5%		269	15.7%		
	All/Most (Percentages combined)			851	20.4%	459	34.0%	**	280	19.0%		453	24.1%		498	29.0%		**Low/High; **Med/High
Rubric-based assessment	1 None	1087	19.7%	689	16.5%	398	29.7%		199	13.6%		386	20.5%		417	24.4%		
	2 Some	1534	27.8%	1168	28.0%	365	27.3%		404	27.6%		516	27.4%		492	28.7%		
	3 Most	1430	25.9%	1143	27.4%	287	21.4%		392	26.8%	2.77	479	25.4%	2.58	431	25.2%	2.44	
	4 All	1462	26.5%	1173	28.1%	289	21.6%		468	32.0%		502	26.7%		372	21.7%		
	All/Most (Percentages combined)			2316	55.5%	576	43.0%	**	860	58.8%		981	52.1%		803	46.9%		**Low/High; *Med/High
Class discussions	1 None	366	6.5%	274	6.5%	91	6.7%		84	5.6%		153	8.0%		99	5.7%		
	2 Some	1345	24.1%	991	23.5%	354	25.9%		309	20.7%		482	25.3%		457	26.3%		
	3 Most	1377	24.6%	1069	25.3%	307	22.5%		385	25.8%	3.16	470	24.7%	3.01	402	23.2%	3.07	
	4 All	2503	44.8%	1888	44.7%	615	45.0%		713	47.8%		798	41.9%		778	44.8%		
	All/Most (Percentages combined)			2957	70.0%	922	67.4%		1098	73.6%		1268	66.6%		1180	68.0%		**Low/High
Cooperative learning (small groups)	1 None	623	11.1%	443	10.5%	178	13.0%		146	9.8%		230	12.1%		198	11.4%		
	2 Some	1748	31.3%	1354	32.1%	394	28.8%		481	32.3%		595	31.3%		538	31.0%		
	3 Most	1547	27.7%	1188	28.2%	359	26.3%		453	30.4%	2.76	508	26.7%	2.75	454	26.2%	2.78	
	4 All	1671	29.9%	1235	29.3%	435	31.8%		410	27.5%		570	30.0%		544	31.4%		
	All/Most (Percentages combined)			2423	57.4%	794	58.1%		863	57.9%		1078	56.6%		998	57.6%		
Experiential learning/Field studies	1 None	2169	39.0%	1586	37.7%	582	42.8%		561	37.8%		736	38.9%		705	40.8%		

	2 Some	1622	29.1%	1221	29.0%	400	29.4%		401	27.0%		571	30.2%		515	29.8%		
	3 Most	977	17.5%	783	18.6%	193	14.2%		296	19.9%	2.13	321	17.0%	2.06	269	15.5%	2.03	
	4 All	799	14.4%	614	14.6%	185	13.6%		226	15.2%		263	13.9%		241	13.9%		
	All/Most (Percentages combined)			1397	33.2%	378	27.8%	**	522	35.2%		584	30.9%		510	29.5%		**Low/High
Performances/Demonstrations	1 None	1916	34.3%	1338	31.8%	577	42.3%		442	29.7%		698	36.8%		674	39.0%		
	2 Some	1721	30.9%	1310	31.1%	411	30.1%		433	29.1%		582	30.6%		537	31.0%		
	3 Most	1103	19.8%	906	21.5%	197	14.4%		357	24.0%	2.29	383	20.2%	2.08	275	15.9%	2.05	
	4 All	838	15.0%	659	15.6%	179	13.1%		256	17.2%		236	12.4%		244	14.1%		
	All/Most (Percentages combined)			1565	37.1%	376	27.6%	**	613	41.2%		619	32.6%		519	30.0%		**Low/High
Group projects	1 None	961	17.2%	704	16.7%	256	18.7%		248	16.6%		334	17.6%		304	17.5%		
	2 Some	1960	35.1%	1505	35.7%	455	33.3%		528	35.4%		667	35.1%		616	35.5%		
	3 Most	1455	26.0%	1103	26.1%	352	25.8%		401	26.9%	2.53	505	26.6%	2.51	419	24.2%	2.52	
	4 All	1212	21.7%	909	21.5%	303	22.2%		316	21.2%		396	20.8%		394	22.7%		
	All/Most (Percentages combined)			2012	47.7%	655	48.0%		717	48.0%		901	47.4%		813	46.9%		
Student-selected topics for course content	1 None	2075	37.1%	1589	37.7%	485	35.5%		566	37.9%		722	38.0%		611	35.3%		
	2 Some	2494	44.6%	1877	44.5%	615	45.1%		646	43.3%		865	45.5%		796	45.9%		
	3 Most	628	11.2%	465	11.0%	163	11.9%		178	11.9%	1.88	201	10.6%	1.84	192	11.1%	1.91	
	4 All	391	7.0%	288	6.8%	102	7.5%		102	6.8%		112	5.9%		134	7.7%		
	All/Most (Percentages combined)			753	17.8%	265	19.4%		280	18.8%		313	16.5%		326	18.8%		
Reflective writing/journaling	1 None	3057	54.8%	2170	51.5%	886	65.1%		719	48.3%		1060	55.9%		1055	61.0%		
	2 Some	1561	28.0%	1246	29.6%	315	23.1%		442	29.7%		535	28.2%		437	25.3%		
	3 Most	566	10.2%	482	11.4%	84	6.2%		199	13.4%	1.83	181	9.5%	1.66	130	7.5%	1.59	
	4 All	390	7.0%	314	7.5%	76	5.6%		130	8.7%		120	6.3%		107	6.2%		
	All/Most (Percentages combined)			796	18.9%	160	11.8%	**	329	22.1%		301	15.9%		237	13.7%		**Low/High
Using real-life problems	1 None	253	4.5%	114	2.7%	137	10.0%		22	1.5%		97	5.1%		123	7.1%		
	2 Some	1060	18.9%	732	17.3%	328	24.0%		207	13.9%		379	19.9%		411	23.7%		
	3 Most	1505	26.9%	1134	26.8%	370	27.1%		386	25.8%	3.42	535	28.1%	3.17	459	26.5%	3.05	
	4 All	2780	49.7%	2250	53.2%	530	38.8%		879	58.8%		894	46.9%		742	42.8%		
	All/Most (Percentages combined)			3384	80.0%	900	65.9%		1265	84.7%		1429	75.0%		1201	69.2%		**Low/High; **Med/High
Using student inquiry to drive learning	1 None	554	9.9%	352	8.4%	201	14.8%		114	7.7%		200	10.5%		213	12.3%		
	2 Some	1987	35.6%	1480	35.1%	507	37.2%		473	31.7%		723	38.1%		657	37.9%		
	3 Most	1600	28.7%	1263	30.0%	337	24.7%		445	29.9%	2.84	538	28.4%	2.64	474	27.3%	2.60	
	4 All	1437	25.8%	1120	26.6%	317	23.3%		458	30.7%		435	22.9%		390	22.5%		
	All/Most (Percentages combined)			2383	56.5%	654	48.0%	**	903	60.6%		973	51.3%		864	49.8%		**Low/High
Student presentations	1 None	854	15.4%	634	15.1%	220	16.3%		231	15.7%		308	16.3%		242	14.0%		
	2 Some	2211	39.9%	1680	40.1%	530	39.2%		558	37.9%		779	41.3%		690	40.0%		
	3 Most	1447	26.1%	1099	26.2%	348	25.7%		395	26.8%	2.50	466	24.7%	2.44	470	27.3%	2.51	
	4 All	1032	18.6%	776	18.5%	255	18.8%		289	19.6%		334	17.7%		322	18.7%		
	All/Most (Percentages combined)			1875	44.8%	603	44.6%		684	46.4%		800	42.4%		792	45.9%		
"Learn before lecture" through multimedia tools (e.g., flipping the classroom)	1 None	2285	41.3%	1654	39.6%	631	46.7%		566	38.5%		791	41.9%		790	46.1%		
	2 Some	2017	36.5%	1552	37.2%	464	34.3%		527	35.9%		720	38.2%		592	34.5%		
	3 Most	710	12.8%	556	13.3%	153	11.3%		222	15.1%	1.98	217	11.5%	1.86	189	11.0%	1.82	
	4 All	519	9.4%	415	9.9%	103	7.6%		155	10.5%		158	8.4%		143	8.3%		
	All/Most (Percentages combined)			971	23.2%	256	18.9%	*	377	25.6%		375	19.9%		332	19.4%		**Low/High
Techniques to create an inclusive classroom environment for diverse students	1 None	1443	26.1%	996	23.9%	446	33.1%		302	20.6%		531	28.3%		531	30.9%		
	2 Some	1586	28.7%	1191	28.6%	393	29.2%		431	29.4%		538	28.6%		487	28.4%		
	3 Most	1264	22.9%	1007	24.1%	257	19.1%		361	24.6%	2.55	414	22.0%	2.36	359	20.9%	2.29	
	4 All	1227	22.2%	977	23.4%	250	18.6%		373	25.4%		395	21.0%		339	19.8%		
	All/Most (Percentages combined)			1984	47.6%	507	37.7%	**	734	50.0%		809	43.1%		698	40.7%		**Low/High
I try to dispel perceptions of competition	1 Disagree Strongly	212	3.8%	165	3.9%	47	3.5%		49	3.3%		79	4.2%		71	4.1%		
	2 Disagree Somewhat	1119	20.1%	856	20.3%	262	19.3%		272	18.3%		407	21.6%		353	20.4%		
	3 Agree Somewhat	2544	45.6%	1932	45.9%	609	44.9%		707	47.5%		870	46.1%		754	43.5%		

	4 Agree Strongly	1698	30.5%	1260	29.9%	438	32.3%		460	30.9%	3.06	532	28.2%	2.98	554	32.0%	3.03	
	Somewhat agree/ Strongly agree (Percentages combined)			3192	75.8%	1047	77.2%		1167	78.4%		1402	74.3%		1308	75.5%		
All students have the potential to excel in my courses	1 Disagree Strongly	86	1.5%	60	1.4%	26	1.9%		17	1.1%		34	1.8%		29	1.7%		
	2 Disagree Somewhat	526	9.4%	374	8.8%	151	11.0%		118	7.9%		197	10.3%		177	10.2%		
	3 Agree Somewhat	1747	31.1%	1286	30.3%	460	33.6%		422	28.1%		637	33.4%		575	33.0%		
	4 Agree Strongly	3262	58.0%	2529	59.5%	733	53.5%		944	62.9%	3.53	1042	54.6%	3.41	961	55.2%	3.42	**Low/High
	Somewhat agree/ Strongly agree (Percentages combined)			3815	89.8%	1193	87.1%	*	1366	91.0%		1679	87.9%		1536	88.2%		
It is primarily up to individual students whether they succeed in my courses	1 Disagree Strongly	94	1.7%	71	1.7%	23	1.7%		28	1.9%		34	1.8%		24	1.4%		
	2 Disagree Somewhat	473	8.4%	352	8.3%	120	8.7%		117	7.8%		165	8.6%		142	8.1%		
	3 Agree Somewhat	2825	50.2%	2126	50.0%	699	50.9%		752	50.1%		976	51.0%		874	50.1%		
	4 Agree Strongly	2240	39.8%	1706	40.1%	531	38.7%		604	40.2%	3.29	740	38.6%	3.26	706	40.4%	3.30	
	Somewhat agree/ Strongly agree (Percentages combined)			3832	90.1%	1230	89.6%		1356	90.3%		1716	89.6%		1580	90.5%		
This institution takes responsibility for educating underprepared students	1 Disagree Strongly	416	7.5%	308	7.4%	108	7.9%		103	7.0%		124	6.6%		150	8.7%		
	2 Disagree Somewhat	1630	29.5%	1169	28.1%	461	33.9%		413	28.2%		535	28.5%		559	32.6%		
	3 Agree Somewhat	2637	47.8%	2034	49.0%	601	44.2%		689	47.0%		947	50.5%		791	46.1%		
	4 Agree Strongly	834	15.1%	644	15.5%	189	13.9%		262	17.9%	2.76	270	14.4%	2.73	215	12.5%	2.62	
	Somewhat agree/ Strongly agree (Percentages combined)			2678	64.5%	790	58.1%	**	951	64.8%		1217	64.9%		1006	58.7%		**Low/High; **Med/High
There is adequate support for faculty development	1 Disagree Strongly	653	11.7%	489	11.6%	164	11.9%		179	12.1%		212	11.1%		203	11.7%		
	2 Disagree Somewhat	1411	25.2%	1056	25.0%	355	25.8%		396	26.7%		451	23.5%		448	25.7%		
	3 Agree Somewhat	2408	43.0%	1801	42.6%	604	43.9%		584	39.3%		867	45.2%		763	43.9%		
	4 Agree Strongly	1132	20.2%	878	20.8%	254	18.4%		326	22.0%	2.71	388	20.2%	2.75	326	18.7%	2.70	
	Somewhat agree/ Strongly agree (Percentages combined)			2679	63.4%	858	62.3%		910	61.3%		1255	65.4%		1089	62.6%		
My teaching is valued by faculty in my department	1 Disagree Strongly	177	3.2%	127	3.0%	50	3.6%		45	3.0%		68	3.6%		55	3.1%		
	2 Disagree Somewhat	447	8.0%	331	7.8%	115	8.3%		110	7.4%		153	8.0%		152	8.7%		
	3 Agree Somewhat	1909	34.0%	1419	33.6%	489	35.5%		472	31.7%		670	35.2%		593	33.9%		
	4 Agree Strongly	3075	54.8%	2349	55.6%	725	52.6%		863	57.9%	3.44	1015	53.3%	3.38	948	54.2%	3.39	
	Somewhat agree/ Strongly agree (Percentages combined)			3768	89.2%	1214	88.0%		1335	89.6%		1685	88.4%		1541	88.2%		
Institutional Priority: Develop a sense of community among students and faculty	1 Low Priority	431	7.7%	303	7.2%	127	9.3%		107	7.2%		160	8.4%		139	8.0%		
	2 Medium Priority	1429	25.6%	1030	24.4%	399	29.1%		382	25.7%		490	25.6%		462	26.7%		
	3 High Priority	2650	47.4%	2033	48.2%	616	45.0%		713	47.9%		897	46.8%		810	46.8%		
	4 Highest Priority	1082	19.3%	854	20.2%	228	16.6%		286	19.2%	2.79	369	19.3%	2.77	319	18.4%	2.76	
	High/Highest (Percentages combined)			2887	68.4%	844	61.6%	**	999	67.1%			66.1%		1129	65.3%		
Structure your courses so that students master a conceptual understanding of course content	1 Not at All	58	1.0%	45	1.1%	12	.9%		17	1.1%		21	1.1%		14	.8%		
	2 To Some Extent	1077	19.3%	817	19.3%	259	19.0%		266	17.9%	2.80	393	20.6%	2.77	314	18.1%	2.80	
	3 To a Great Extent	4456	79.7%	3362	79.6%	1094	80.1%		1203	81.0%		1491	78.3%		1410	81.1%		
Help students evaluate the quality and reliability of information	1 Not Important	843	15.2%	605	14.5%	238	17.4%		216	14.6%		290	15.3%		280	16.2%		
	2 Somewhat Important	1717	31.0%	1306	31.3%	411	30.1%		448	30.4%		601	31.6%		517	29.9%		
	3 Very Important	1973	35.6%	1521	36.4%	451	33.0%		533	36.1%		676	35.6%		599	34.6%		
	4 Essential	1012	18.3%	744	17.8%	267	19.5%		278	18.8%	2.59	332	17.5%	2.55	333	19.3%	2.57	
	Essential/Very Important (Percentages combined)			2265	54.2%	718	52.5%		811	55.0%		1008	53.1%		932	53.9%		

Stress: Committee work	1 Not Applicable	334	5.9%	263	6.2%	70	5.1%		103	6.9%		107	5.6%		96	5.5%		
	2 Not at All	2095	37.3%	1516	35.7%	579	42.0%	**	512	34.2%	2.62	728	38.0%	2.62	681	39.0%	2.60	*Low/High
	3 Somewhat	2578	45.8%	1992	47.0%	585	42.4%		727	48.6%		858	44.8%		799	45.7%		
	4 Extensive	617	11.0%	471	11.1%	145	10.5%		153	10.2%		223	11.6%		171	9.8%		
Stress: Students	1 Not Applicable	48	.9%	37	.9%	11	.8%		8	.5%		21	1.1%		16	.9%		
	2 Not at All	2049	36.4%	1509	35.6%	540	39.1%		532	35.6%	2.71	704	36.7%	2.69	647	37.1%	2.68	
	3 Somewhat	3105	55.2%	2383	56.2%	722	52.2%		831	55.7%		1047	54.6%		965	55.3%		
	4 Extensive	421	7.5%	311	7.3%	109	7.9%		122	8.2%		147	7.7%		118	6.8%		
Stress: Teaching load	1 Not Applicable	113	2.0%	86	2.0%	27	2.0%		20	1.3%		63	3.3%		25	1.4%		
	2 Not at All	1994	35.4%	1428	33.6%	565	41.0%		506	34.0%	2.81	673	35.0%	2.74	652	37.4%	2.74	
	3 Somewhat	2628	46.7%	2001	47.1%	625	45.3%		694	46.6%		893	46.4%		819	47.0%		
	4 Extensive	893	15.9%	731	17.2%	162	11.7%	**	270	18.1%		296	15.4%		247	14.2%		*Low/High
Stress: Lack of personal time	1 Not Applicable	37	.7%	33	.8%	4	.3%		15	1.0%		11	.6%		7	.4%		
	2 Not at All	1403	24.9%	1084	25.5%	319	23.1%		410	27.5%	2.96	457	23.8%	3.03	404	23.1%	3.05	*Low/High
	3 Somewhat	2653	47.1%	1975	46.5%	677	49.1%		689	46.2%		910	47.3%		831	47.5%		
	4 Extensive	1538	27.3%	1158	27.2%	379	27.5%		378	25.3%		544	28.3%		506	28.9%		
Stress: Working with underprepared students	1 Not Applicable	114	2.0%	88	2.1%	26	1.9%		25	1.7%		45	2.3%		38	2.2%		
	2 Not at All	1965	34.9%	1393	32.8%	572	41.5%		484	32.5%	2.77	663	34.5%	2.70	681	39.0%	2.64	
	3 Somewhat	2992	53.2%	2309	54.4%	680	49.3%		796	53.4%		1033	53.7%		903	51.7%		
	4 Extensive	557	9.9%	457	10.8%	100	7.3%	**	185	12.4%		181	9.4%		124	7.1%		
Stress: Self-imposed high expectations	1 Not Applicable	36	.6%	28	.7%	8	.6%		12	.8%		11	.6%		12	.7%	3.22	
	2 Not at All	844	15.0%	664	15.6%	180	13.0%		244	16.4%	3.11	271	14.1%	3.19	228	13.0%		
	3 Somewhat	2884	51.2%	2214	52.1%	669	48.3%		802	53.8%		992	51.6%		866	49.5%		
	4 Extensive	1871	33.2%	1340	31.6%	529	38.2%	**	433	29.0%		649	33.7%		645	36.8%		**Low/High
How many courses are you teaching this term (include all institutions at which you teach) (e.g., 0,1,2,3)?	1 0 to 2	3136	55.3%	2063	48.2%	1071	76.8%	**	651	43.3%		1148	59.4%		1134	64.3%		**Low/High; *Med/High
	2 3 to 4	2097	37.0%	1808	42.3%	288	20.7%		672	44.7%	1.69	670	34.7%	1.47	540	30.6%	1.41	
	3 5+	441	7.8%	405	9.5%	35	2.5%		180	12.0%		115	5.9%		89	5.0%		**Low/High
Hours per Week: Preparing for teaching (including reading student papers and grading)	1 None to 4	1203	21.3%	811	19.0%	390	28.0%		278	18.6%		415	21.5%		404	22.9%		
	2 5 to 12	2559	45.2%	1926	45.2%	632	45.3%		682	45.6%	2.17	857	44.3%	2.13	800	45.4%	2.09	
	3 13+	1898	33.5%	1525	35.8%	373	26.7%	**	534	35.7%		662	34.2%		557	31.6%		
Participated in organized activities around enhancing pedagogy and student learning	1 No	2130	38.0%	1502	35.7%	626	44.9%		528	35.7%		706	36.8%		715	40.9%		
	2 Yes	3476	62.0%	2708	64.3%	768	55.1%	**	950	64.3%	1.64	1211	63.2%	1.63	1035	59.1%	1.59	*Low/High
Applied for Internal grants for research	1 Not Available	282	5.0%	222	5.2%	59	4.2%		103	6.9%		60	3.1%		68	3.9%		
	2 Not Eligible	346	6.1%	272	6.4%	73	5.2%		105	7.0%	3.14	114	5.9%	3.23	94	5.4%	3.25	
	3 No	3021	53.5%	2290	53.9%	731	52.6%		765	51.1%		1067	55.4%		923	52.6%		
	4 Yes	1996	35.4%	1468	34.5%	528	38.0%		523	35.0%		685	35.6%		670	38.2%		
Engaged undergraduates on your research project	1 No	2246	40.0%	1904	45.1%	342	24.5%		718	48.2%	1.52	713	37.1%	1.63	549	31.4%	1.69	
	2 Yes	3374	60.0%	2319	54.9%	1053	75.5%		771	51.8%		1211	62.9%		1200	68.6%		**Low/High; **Med/High
Worked with undergraduates on a research project	1 No	1746	31.0%	1490	35.2%	255	18.3%		565	37.8%	1.62	540	28.1%	1.72	420	23.9%	1.76	
	2 Yes	3884	69.0%	2742	64.8%	1140	81.7%	**	930	62.2%		1381	71.9%		1334	76.1%		**Low/High; *Med/High
Presented with undergraduate students at conferences	1 Not at All	3190	57.6%	2492	60.2%	698	50.3%	**	869	59.6%		1074	56.8%		921	53.1%		**Low/High
	2 To Some Extent	1607	29.0%	1136	27.4%	470	33.8%		398	27.3%	1.53	563	29.8%	1.57	551	31.8%	1.62	
	3 To a Great Extent	737	13.3%	513	12.4%	221	15.9%		190	13.0%		255	13.5%		262	15.1%		
Published with undergraduates	1 Not at All	3679	66.7%	2954	71.6%	725	52.2%	**	1036	71.4%		1253	66.3%		1023	59.2%		**Low/High; **Med/High
	2 To Some Extent	1365	24.7%	888	21.5%	474	34.1%		300	20.7%	1.36	481	25.5%	1.42	515	29.8%	1.52	
	3 To a Great Extent	472	8.6%	281	6.8%	190	13.7%		114	7.9%		155	8.2%		189	10.9%		
Published: Articles in academic or professional journals	1 None	1009	17.9%	906	21.4%	99	7.1%	**	379	25.4%		274	14.2%		211	12.0%		**Low/High
	2 1-2	878	15.6%	742	17.5%	136	9.8%		278	18.6%		288	14.9%		232	13.2%		
	3 3-4	602	10.7%	487	11.5%	115	8.2%		171	11.5%		209	10.8%		168	9.6%		
	4 5-10	929	16.5%	725	17.1%	204	14.6%		239	16.0%	3.26	343	17.8%	3.97	269	15.3%	4.30	
	5 11-20	805	14.3%	575	13.6%	230	16.5%		176	11.8%		302	15.7%		271	15.5%		
	6 21-50	760	13.5%	487	11.5%	273	19.6%		152	10.2%		285	14.8%		290	16.5%		
	7 51+	658	11.7%	321	7.6%	337	24.2%		96	6.4%		226	11.7%		313	17.8%		
Published: Chapters in edited volumes	1 None	3208	57.8%	2603	62.3%	604	44.0%	**	964	65.5%		1072	56.6%		861	49.8%		**Low/High; **Med/High
	2 1-2	1291	23.2%	953	22.8%	336	24.5%		323	22.0%		447	23.6%		431	24.9%		
	3 3-4	511	9.2%	324	7.8%	187	13.6%		109	7.4%		190	10.0%		187	10.8%		
	4 5-10	344	6.2%	201	4.8%	143	10.4%		53	3.6%	1.54	108	5.7%	1.79	157	9.1%	1.98	
	5 11-20	123	2.2%	60	1.4%	63	4.6%		14	1.0%		51	2.7%		52	3.0%		

	6 21-50	64	1.2%	30	.7%	34	2.5%		7	.5%		21	1.1%		34	2.0%		
	7 51+	12	.2%	6	.1%	6	.4%		1	.1%		5	.3%		6	.3%		
In the past two years, how many of your professional writings have been published or accepted for publication?	1 None	2072	36.7%	1783	42.0%	288	20.6%	**	687	46.0%		662	34.3%		484	27.5%		**Low/High; **Med/High
	2 1-2	1605	28.4%	1231	29.0%	374	26.7%		406	27.2%		571	29.6%		511	29.0%		
	3 3-4	855	15.1%	571	13.4%	284	20.3%		185	12.4%	2.01	316	16.4%	2.29	303	17.2%	2.56	
	4 5-10	756	13.4%	485	11.4%	270	19.3%		150	10.1%		268	13.9%		293	16.6%		
	5 11-20	236	4.2%	112	2.6%	123	8.8%		45	3.0%		79	4.1%		104	5.9%		
	6 21+	126	2.2%	64	1.5%	61	4.4%		19	1.3%		33	1.7%		66	3.7%		

Note: All STEM efficiency means that efficiency scores were based on the production of STEM degrees by all students seeking a STEM degree, irrespective of their race and gender.

*p < .05; **p < .01

Table 2. SEM for Research-Teaching Nexus Including the Control Variables for ONLY the Highly efficient All STEM Group Parameter Estimates for Direct Effects & Covariance

	All Institutions		
	β	S.E.	Sig.
Primary Findings (The same across institutional type)			
Teaching-Research Nexus			
Student-Centered Pedagogy	1.049	0.057	***
Scholarly Productivity	0.162	0.033	***
Covariance: Scholarly Productivity & Student-	0.098	0.032	**

Secondary Findings by Institutional type	Liberal Arts Institutions			Comprehensive Institutions			Research Institutions		
	β	S.E.	Sig.	β	S.E.	Sig.	β	S.E.	Sig.
Teaching-Research Nexus									
Sex of Faculty	0.185	0.106	n.s.	0.011	0.130	n.s.	0.206	0.085	*
Number of courses teaching the term survey was taken at all institutions in which the individual teaches (e.g., 0, 1, 2, 3)	0.115	0.043	**	0.029	0.044	n.s.	0.108	0.032	**
Academic Rank (Higher number indicating more senior faculty)	0.033	0.050	n.s.	0.098	0.055	n.s.	0.121	0.041	**
Scholarly Productivity									
Sex of Faculty	-0.241	0.110	*	-0.464	0.124	***	-0.335	0.079	***
Number of courses teaching the term survey was taken at all institutions in which the individual teaches (e.g., 0, 1, 2, 3)	-0.035	0.044	n.s.	-0.045	0.043	n.s.	-0.172	0.030	***
Academic Rank (Higher number indicating more senior faculty)	0.369	0.051	***	0.432	0.052	***	0.713	0.036	***
Student-Centered Pedagogy									
Sex of Faculty	0.525	0.103	***	0.524	0.121	***	0.388	0.078	***
Number of courses teaching the term survey was taken at all institutions in which the individual teaches (e.g., 0, 1, 2, 3)	0.051	0.042	n.s.	0.028	0.042	n.s.	0.093	0.029	**
Academic Rank (Higher number indicating more senior faculty)	0.010	0.047	n.s.	-0.088	0.048	n.s.	-0.095	0.031	**

Note: n= 1825 STEM faculty across 75 institutions considered to be "highly efficient" in producing STEM degrees among students (irrespective of race or gender) considering the resources to which they have access; $\chi^2 = 1184.693$ df = 590 CFI = 0.951 RMSEA = 0.041 SRMR = 0.054

*p<.05 **p<.01 ***p<.001

Table 3. Factors predicting faculty use of "Research -Teaching Nexus", which is the frequency of using research discipline-based assignments as a teaching tool in class.

	Beta (unstandardized)	S.E.	Beta (standardized)	t	Sig.
Intercept	2.60	1.54		1.69	
Faculty Demographic Characteristics					
Sex (higher value is female)	-0.02	0.21	0.00	-0.09	
Associate Professor (compared to full professor)	0.06	0.23	0.00	0.24	
Assistant Professor (compared to full professor)	-0.18	0.25	-0.01	-0.71	
Non-tenure faculty member (compared to full professor)	-0.70	0.33	-0.02	-2.14	*
Underrepresented Racial Minority (compared to white or Asian)	0.18	0.40	0.00	0.43	
Number of courses being taught during current term (include all institutions at which you teach) (e.g., 0,1,2,3)? (20 maximum)	0.46	0.07	0.08	6.19	***
Faculty is from agriculture or forestry department (compared to the Biological Sciences)	-1.08	0.49	-0.02	-2.20	*
Faculty is from other engineering department (compared to the Biological Sciences)	-1.36	0.36	-0.04	-3.77	***
Faculty is from health-related department	1.90	0.30	0.09	6.24	***
Faculty is from mathematics or statistics department (compared to the Biological Sciences)	-3.44	0.34	-0.13	-10.21	***
Faculty is from Physical Sciences department (compared to the Biological Sciences)	-1.25	0.28	-0.06	-4.47	***
Faculty is from Other Technical department (compared to the Biological Sciences)	-3.34	0.39	-0.10	-8.52	***
Institutional Characteristics					
Institution got HHMI funding in last 2 rounds of awards	0.29	0.25	0.01	1.18	
Control of institution (Higher value private)	-0.52	0.24	-0.03	-2.14	*
Full-time equivalent fall enrollment	-0.01	0.01	-0.01	-0.87	
Percent of students admitted from the total who applied	-0.01	0.01	-0.02	-1.57	
Liberal Arts Institution (compared to Masters Comprehensive)	-0.32	0.27	-0.02	-1.16	
Research Institution (compared to Masters Comprehensive)	-0.19	0.28	-0.01	-0.67	
Faculty Opinions and Perceptions					
Opinion: This institution takes responsibility for educating underprepared students	-0.07	0.12	-0.01	-0.54	

Inst Priority: Develop a sense of community among students and faculty	0.22	0.12	0.02	1.93	
Opinion: There is adequate support for faculty development	-0.20	0.11	-0.02	-1.82	
Opinion: All students have the potential to excel in my courses	0.35	0.13	0.03	2.63	**
Faculty behaviors					
Prof Develop-Internal grants for Research	0.57	0.21	0.03	2.74	**
Extent to which faculty engaged students in research	0.09	0.01	0.09	6.79	***
Construct: Scholarly Productivity	0.10	0.01	0.10	7.12	***
Hours per Week: Preparing for teaching (including reading student papers and grading)	0.19	0.06	0.03	2.95	**
Faculty pedagogy, approaches to teaching, and goals for student outcomes					
Construct: Use of student-centered pedagogy	0.31	0.01	0.31	23.15	***
Method: "Learn before lecture" through multimedia tools (e.g., flipping the classroom)	0.28	0.11	0.03	2.65	**
Method: Techniques to create an inclusive classroom environment for diverse students	0.49	0.10	0.06	5.06	***
Assessment: Provide feedback on drafts or work still in progress	1.76	0.15	0.13	11.84	***
Assessment: Explicitly link the assignment with course goals or learning objectives	1.33	0.16	0.09	8.24	***
Assessment: Provide instructions clearly delineating what students are to do to complete the assignment	1.44	0.25	0.06	5.75	***
Affect: Structure your courses so that students master a conceptual understanding of course content	1.09	0.22	0.05	5.01	***
Habits of Mind: Accept mistakes as part of the learning process	1.14	0.16	0.08	7.26	***
Goal: Help students evaluate the quality and reliability of information	0.72	0.10	0.08	7.16	***
Method: Grading on a curve	0.06	0.09	0.01	0.61	
Method: Rubric-based assessment	0.05	0.10	0.01	0.47	

Note: p<.05*, p<.01**, p<.001

n= 5952 faculty across 265 institutions

Table 4. Descriptive Statistics for Women Efficiency Percentages Distributed by Group for Variables of Interest

		"Low" Efficiency Institutions (N= 94 Institutions; 1460 faculty)			"Medium" Efficiency Institutions (N= 71 Institutions; 2028 faculty)			"High" Efficiency Institutions (N= 68 Institutions; 1639 faculty)			
		Count	Column Valid N %	Mean Score	Count	Column Valid N %	Mean Score	Count	Column Valid N %	Mean Score	Significant Differences Between Efficiency Groups
Provide instructions clearly delineating what students are to do to complete the assignment	1 Not at All	37	2.6%	2.83	20	1.0%	2.88	22	1.4%	2.88	
	2 Occasionally	168	11.7%		195	9.7%		154	9.6%		
	3 Frequently	1234	85.8%		1786	89.3%		1432	89.1%		*Low/High
Explicitly link the assignment with course goals or learning objectives	1 Not at All	127	8.9%	2.48	143	7.2%	2.54	117	7.3%	2.54	
	2 Occasionally	498	34.7%		636	31.8%		505	31.5%		
	3 Frequently	809	56.4%		1218	61.0%		981	61.2%		
Engage deeply with a significant challenge or question within your discipline	1 Not at All	245	17.0%	2.24	246	12.3%	2.33	201	12.5%	2.35	
	2 Occasionally	599	41.7%		838	42.0%		649	40.4%		
	3 Frequently	593	41.3%		909	45.6%		756	47.1%		*Low/High
Write in the specific style or format of your discipline	1 Not at All	234	16.3%	2.35	280	14.1%	2.40	204	12.7%	2.44	
	2 Occasionally	463	32.2%		631	31.7%		489	30.5%		
	3 Frequently	740	51.5%		1079	54.2%		909	56.7%		*Low/High
Use research methods from your discipline in field or applied settings	1 Not at All	282	19.7%	2.24	346	17.4%	2.29	271	16.9%	2.33	
	2 Occasionally	531	37.0%		730	36.6%		527	32.8%		
	3 Frequently	621	43.3%		916	46.0%		807	50.3%		**Low/High
Apply learning from both academic and field settings	1 Not at All	360	25.1%	2.15	465	23.3%	2.19	362	22.7%	2.24	
	2 Occasionally	506	35.2%		680	34.1%		490	30.7%		
	3 Frequently	570	39.7%		848	42.5%		742	46.5%		**Low/High
Describe how different perspectives would affect the interpretation of a question or issue in your discipline	1 Not at All	474	33.0%	1.91	596	29.9%	1.96	461	28.8%	2.01	
	2 Occasionally	616	42.9%		879	44.2%		658	41.2%		
	3 Frequently	345	24.0%		515	25.9%		480	30.0%		**Low/High
Weigh the meaning and significance of evidence	1 Not at All	208	14.5%	2.39	230	11.5%	2.44	166	10.4%	2.50	
	2 Occasionally	466	32.5%		649	32.5%		475	29.7%		
	3 Frequently	761	53.0%		1118	56.0%		960	60.0%		**Low/High
Provide feedback on drafts or work still in progress	1 Not at All	209	14.6%	2.23	292	14.6%	2.21	201	12.5%	2.27	
	2 Occasionally	688	48.0%		998	50.1%		775	48.2%		
	3 Frequently	536	37.4%		704	35.3%		632	39.3%		
Grading on a curve	1 None	741	52.7%	1.83	1024	52.0%	1.84	858	53.9%	1.85	
	2 Some	335	23.8%		464	23.5%		334	21.0%		
	3 Most	163	11.6%		253	12.8%		175	11.0%		
	4 All	168	11.9%		230	11.7%		225	14.1%		
	All/Most (Percentages combined)		23.5%			24.5%			25.1%		
Rubric-based assessment	1 None	296	21.1%	2.55	347	17.6%	2.63	344	21.7%	2.57	
	2 Some	394	28.1%		562	28.5%		427	27.0%		
	3 Most	355	25.3%		542	27.5%		382	24.1%		
	4 All	359	25.6%		522	26.5%		430	27.2%		
	All/Most (Percentages combined)		50.9%			53.9%			51.3%		
Class discussions	1 None	128	9.0%	2.96	108	5.4%	3.13	94	5.8%	3.09	
	2 Some	372	26.1%		452	22.7%		400	24.9%		
	3 Most	361	25.3%		499	25.1%		375	23.3%		
	4 All	567	39.7%		933	46.8%		740	46.0%		
	All/Most (Percentages combined)		65.0%			71.9%			69.3%		
Cooperative learning (small groups)	1 None	194	13.6%	2.69	186	9.4%	2.82	178	11.1%	2.76	
	2 Some	450	31.5%		612	30.8%		514	32.0%		
	3 Most	394	27.6%		571	28.7%		428	26.6%		
	4 All	392	27.4%		620	31.2%		487	30.3%		
	All/Most (Percentages combined)		55.0%			59.9%			56.9%		
Experiential learning/Field studies	1 None	566	39.8%		753	38.0%		640	40.0%		
	2 Some	430	30.2%		591	29.8%		443	27.7%		

	3 Most	243	17.1%	2.03	349	17.6%	2.09	275	17.2%	2.07	
	4 All	183	12.9%		289	14.6%		242	15.1%		
	All/Most (Percentages combined)		30.0%			32.2%			32.3%		
Performances/Demonstrations	1 None	489	34.3%	2.12	679	34.2%	2.17	617	38.5%	2.07	
	2 Some	461	32.3%		587	29.6%		475	29.6%		
	3 Most	290	20.3%		414	20.8%		288	18.0%		
	4 All	187	13.1%		306	15.4%		223	13.9%		
	All/Most (Percentages combined)		33.4%			36.3%			31.9%		*Med/High
Group projects	1 None	270	18.8%	2.48	311	15.6%	2.56	280	17.4%	2.50	
	2 Some	508	35.5%		696	35.0%		575	35.8%		
	3 Most	357	24.9%		536	26.9%		412	25.7%		
	4 All	298	20.8%		446	22.4%		339	21.1%		
	All/Most (Percentages combined)		45.7%			49.4%			46.8%		
Student-selected topics for course content	1 None	563	39.3%	1.85	732	36.8%	1.86	560	34.9%	1.92	
	2 Some	622	43.5%		912	45.9%		732	45.6%		
	3 Most	147	10.3%		226	11.4%		189	11.8%		
	4 All	99	6.9%		117	5.9%		125	7.8%		
	All/Most (Percentages combined)		17.2%			17.3%			19.6%		
Reflective writing/journaling	1 None	820	57.6%	1.63	1096	55.2%	1.68	862	53.7%	1.74	
	2 Some	385	27.1%		560	28.2%		448	27.9%		
	3 Most	137	9.6%		210	10.6%		150	9.4%		
	4 All	81	5.7%		121	6.1%		144	9.0%		
	All/Most (Percentages combined)		15.3%			16.7%			18.3%		
Using real-life problems	1 None	68	4.7%	3.20	79	4.0%	3.24	95	5.9%	3.14	
	2 Some	284	19.8%		370	18.6%		330	20.5%		
	3 Most	374	26.1%		536	26.9%		438	27.3%		
	4 All	707	49.3%		1009	50.6%		743	46.3%		
	All/Most (Percentages combined)		75.4%			77.5%			73.5%		
Using student inquiry to drive learning	1 None	142	9.9%	2.69	184	9.3%	2.71	186	11.6%	2.64	
	2 Some	529	36.9%		709	35.7%		586	36.6%		
	3 Most	393	27.4%		590	29.7%		445	27.8%		
	4 All	368	25.7%		501	25.3%		386	24.1%		
	All/Most (Percentages combined)		53.1%			55.0%			51.8%		
Student presentations	1 None	235	16.7%	2.43	284	14.3%	2.48	230	14.4%	2.55	
	2 Some	582	41.3%		810	40.8%		601	37.7%		
	3 Most	344	24.4%		539	27.2%		425	26.7%		
	4 All	247	17.5%		350	17.7%		337	21.2%		
	All/Most (Percentages combined)		42.0%			44.8%			47.8%		*Low/High
"Learn before lecture" through multimedia tools (e.g., flipping the classroom)	1 None	625	44.5%	1.84	787	39.8%	1.91	691	43.5%	1.87	
	2 Some	495	35.2%		750	38.0%		564	35.5%		
	3 Most	165	11.7%		264	13.4%		190	11.9%		
	4 All	121	8.6%		175	8.9%		145	9.1%		
	All/Most (Percentages combined)		20.3%			22.2%			21.1%		
Techniques to create an inclusive classroom environment for diverse students	1 None	392	27.9%	2.41	502	25.4%	2.38	443	28.0%	2.39	
	2 Some	375	26.7%		619	31.3%		433	27.4%		
	3 Most	310	22.1%		458	23.2%		346	21.9%		
	4 All	326	23.2%		398	20.1%		361	22.8%		
	All/Most (Percentages combined)		45.3%			43.3%			44.7%		
I try to dispel perceptions of competition	1 Disagree Strongly	68	4.8%	2.94	73	3.7%	3.05	54	3.4%	3.07	
	2 Disagree Somewhat	337	23.5%		374	18.9%		296	18.6%		
	3 Agree Somewhat	639	44.7%		923	46.5%		731	45.8%		
	4 Agree Strongly	387	27.0%		613	30.9%		514	32.2%		

	Somewhat agree/ Strongly agree (Percentages combined)		71.7%			77.5%			78.1%		**Low/High
All students have the potential to excel in my courses	1 Disagree Strongly	27	1.9%		28	1.4%		25	1.6%		
	2 Disagree Somewhat	144	10.0%		192	9.6%		146	9.1%		
	3 Agree Somewhat	473	32.9%		625	31.2%		510	31.7%		
	4 Agree Strongly	793	55.2%	3.41	1161	57.9%	3.46	929	57.7%	3.46	
	Somewhat agree/ Strongly agree (Percentages combined)		88.1%			89.0%			89.4%		
It is primarily up to individual students whether they succeed in my courses	1 Disagree Strongly	26	1.8%		29	1.4%		30	1.9%		
	2 Disagree Somewhat	111	7.7%		155	7.7%		150	9.3%		
	3 Agree Somewhat	702	48.7%		1010	50.3%		842	52.2%		
	4 Agree Strongly	603	41.8%	3.31	813	40.5%	3.30	590	36.6%	3.24	
	Somewhat agree/ Strongly agree (Percentages combined)		90.5%			90.8%			88.8%		
This institution takes responsibility for educating underprepared students	1 Disagree Strongly	90	6.4%		152	7.7%		133	8.4%		
	2 Disagree Somewhat	379	26.9%		600	30.5%		512	32.3%		
	3 Agree Somewhat	727	51.6%		917	46.7%		721	45.5%		
	4 Agree Strongly	212	15.1%	2.75	296	15.1%	2.69	220	13.9%	2.65	
	Somewhat agree/ Strongly agree (Percentages combined)		66.7%			61.7%			59.3%		**Low/High
There is adequate support for faculty development	1 Disagree Strongly	200	14.0%		195	9.8%		192	11.9%		
	2 Disagree Somewhat	363	25.4%		409	20.5%		496	30.7%		
	3 Agree Somewhat	598	41.8%		913	45.7%		653	40.5%		
	4 Agree Strongly	269	18.8%	2.65	482	24.1%	2.84	273	16.9%	2.62	
	Somewhat agree/ Strongly agree (Percentages combined)		60.6%			69.8%			57.4%		**Med/High
My teaching is valued by faculty in my department	1 Disagree Strongly	59	4.1%		57	2.9%		50	3.1%		
	2 Disagree Somewhat	114	8.0%		163	8.2%		126	7.8%		
	3 Agree Somewhat	478	33.5%		673	33.7%		550	34.0%		
	4 Agree Strongly	777	54.4%	3.38	1106	55.3%	3.41	890	55.1%	3.41	
	Somewhat agree/ Strongly agree (Percentages combined)		87.9%			89.0%			89.1%		
Institutional Priority: Develop a sense of community among students and faculty	1 Low Priority	112	7.8%		167	8.4%		119	7.4%		
	2 Medium Priority	342	23.8%		535	26.9%		434	27.0%		
	3 High Priority	687	47.8%		953	47.9%		733	45.6%		
	4 Highest Priority	296	20.6%	2.81	333	16.8%	2.73	323	20.1%	2.78	
	High/Highest (Percentages combined)		68.4%			64.7%			65.6%		
Structure your courses so that students master a conceptual understanding of course content	1 Not at All	15	1.0%		20	1.0%		16	1.0%		
	2 To Some Extent	298	20.8%	2.77	358	18.0%	2.80	289	18.0%	2.80	
	3 To a Great Extent	1119	78.1%		1614	81.0%		1299	81.0%		
Help students evaluate the quality and reliability of information	1 Not Important	233	16.3%		280	14.1%		259	16.3%		
	2 Somewhat Important	436	30.5%		640	32.2%		452	28.5%		
	3 Very Important	510	35.6%	2.55	717	36.1%	2.57	552	34.8%	2.59	
	4 Essential	252	17.6%		349	17.6%		323	20.4%		
	Essential/Very Important (Percentages combined)		53.2%			53.7%			55.2%		
Stress: Committee work	1 Not Applicable	100	7.0%		100	5.0%		94	5.8%		
	2 Not at All	560	39.0%	2.56	709	35.4%	2.66	615	38.0%	2.61	
	3 Somewhat	644	44.8%		966	48.2%		729	45.1%		
	4 Extensive	133	9.3%		228	11.4%		179	11.1%		
Stress: Students	1 Not Applicable	17	1.2%		12	.6%		15	.9%		
	2 Not at All	560	38.9%	2.65	681	34.0%	2.73	613	38.0%	2.67	
	3 Somewhat	764	53.1%		1150	57.4%		872	54.0%		
	4 Extensive	97	6.7%		162	8.1%		115	7.1%		
Stress: Teaching load	1 Not Applicable	51	3.5%		28	1.4%		27	1.7%		

	2 Not at All	490	34.1%	2.75	685	34.3%	2.79	623	38.5%	2.73	
	3 Somewhat	660	45.9%		975	48.8%		728	45.0%		
	4 Extensive	238	16.5%		312	15.6%		240	14.8%		
Stress: Lack of personal time	1 Not Applicable	18	1.3%	2.99	7	.3%	3.03	7	.4%	3.03	
	2 Not at All	372	25.9%		475	23.7%		396	24.5%		
	3 Somewhat	660	45.9%		978	48.7%		755	46.7%		
	4 Extensive	388	27.0%		548	27.3%		457	28.3%		
Stress: Working with underprepared students	1 Not Applicable	36	2.5%	2.73	37	1.8%	2.68	35	2.2%	2.67	
	2 Not at All	459	31.9%		748	37.3%		594	36.8%		*Low/High
	3 Somewhat	793	55.2%		1040	51.8%		849	52.6%		
	4 Extensive	149	10.4%		181	9.0%		137	8.5%		
Stress: Self-imposed high expectations	1 Not Applicable	16	1.1%	3.15	9	.4%	3.23	10	.6%	3.15	
	2 Not at All	222	15.4%		250	12.5%		250	15.5%		
	3 Somewhat	728	50.6%		1028	51.2%		846	52.3%		
	4 Extensive	472	32.8%		721	35.9%		512	31.6%		
How many courses are you teaching this term (include all institutions at which you teach) (e.g., 0,1,2,3)?	1 0 to 2	726	49.8%	1.60	1184	59.0%	1.47	983	60.5%	1.46	**Low/High
	2 3 to 4	594	40.7%		705	35.0%		530	32.6%		
	3 5+	138	9.5%		125	6.2%		113	6.9%		
Hours per Week: Preparing for teaching (including reading student papers and grading)	1 None to 4	292	20.0%	2.16	386	19.2%	2.15	403	24.8%	2.07	*Low/High, **Med/High
	2 5 to 12	637	44.0%		943	46.9%		714	43.9%		
	3 13+	519	35.8%		683	33.9%		511	31.4		
Participated in organized activities around enhancing pedagogy and student learning	1 No	593	41.4%	1.59	685	34.4%	1.66	632	39.0%	1.61	
	2 Yes	838	58.6%		1309	65.6%		988	61.0%		
Applied to internal grants for research	1 Not Available	78	5.4%	3.17	53	2.6%	3.31	93	5.7%	3.15	
	2 Not Eligible	98	6.8%		111	5.5%		94	5.8%		
	3 No	768	53.1%		1013	50.5%		916	56.4%		
	4 Yes	503	34.8%		829	41.3%		520	32.0%		**Med/High
Engaged undergraduates on your research project	1 No	563	39.1%	1.61	704	35.1%	1.65	649	40.1%	1.60	
	2 Yes	878	60.9%		1300	64.9%		970	59.9%		*Med/High
Worked with undergraduates on a research project	1 No	414	28.6%	1.71	531	26.5%	1.73	527	32.5%	1.68	
	2 Yes	1032	71.4%		1471	73.5%		1096	67.5%		**Med/High
Presented with undergraduate students at conferences	1 Not at All	781	55.0%	1.59	1054	53.6%	1.62	953	59.5%	1.53	*Med/High
	2 To Some Extent	439	30.9%		603	30.7%		456	28.4%		
	3 To a Great Extent	199	14.0%		308	15.7%		194	12.1%		
Published with undergraduates	1 Not at All	971	68.6%	1.38	1194	61.1%	1.50	1063	66.5%	1.42	*Med/High
	2 To Some Extent	346	24.5%		536	27.4%		404	25.3%		
	3 To a Great Extent	98	6.9%		225	11.5%		132	8.3%		
Published articles in academic or professional journals	1 None	284	19.7%	3.64	284	14.2%	4.00	259	16.0%	4.02	
	2 1-2	234	16.2%		310	15.4%		233	14.4%		
	3 3-4	162	11.2%		204	10.2%		168	10.4%		
	4 5-10	263	18.2%		332	16.5%		246	15.2%		
	5 11-20	190	13.2%		323	16.1%		224	13.8%		
	6 21-50	161	11.2%		309	15.4%		252	15.5%		
	7 51+	148	10.3%		245	12.2%		240	14.8%		
Published chapters in edited volumes	1 None	868	61.0%	1.68	1115	56.3%	1.77	835	52.4%	1.92	**Low/High
	2 1-2	321	22.6%		479	24.2%		388	24.4%		
	3 3-4	116	8.2%		200	10.1%		167	10.5%		
	4 5-10	69	4.9%		130	6.6%		118	7.4%		
	5 11-20	34	2.4%		36	1.8%		46	2.9%		
	6 21-50	12	.8%		18	.9%		31	1.9%		
	7 51+	2	.1%		2	.1%		7	.4%		
In the past two years, how many of your professional writings have been published or accepted for publication?	1 None	593	41.1%	2.14	647	32.1%	2.36	534	32.9%	2.40	**Low/High
	2 1-2	399	27.7%		602	29.9%		464	28.6%		
	3 3-4	207	14.3%		329	16.3%		258	15.9%		
	4 5-10	170	11.8%		301	14.9%		234	14.4%		
	5 11-20	50	3.5%		95	4.7%		82	5.0%		
	6 21+	24	1.7%		41	2.0%		52	3.2%		

Note: Women efficiency means that efficiency scores were based on the production of STEM degrees by female students seeking a STEM degree.
*p < .05; **p < .01

Table 5. Descriptive Statistics for Latino Efficiency Percentages Distributed by Group for Variables of Interest

		"Low" Efficiency Institutions (N= 111 Institutions; 1836 faculty)			"Medium" Efficiency Institutions (N= 66 Institutions; 1375 faculty)			"High" Efficiency Institutions (N= 43 Institutions; 1894 faculty)			
		Count	Column Valid N %	Mean Score	Count	Column Valid N %	Mean Score	Count	Column Valid N %	Mean Score	Significant Differences Between Efficiency Groups
Provide instructions clearly delineating what students are to do to complete the assignment	1 Not at All	37	2.0%	2.86	17	1.3%	2.86	25	1.3%	2.88	
	2 Occasionally	186	10.3%		160	11.8%		178	9.6%		
	3 Frequently	1587	87.7%		1180	87.0%		1657	89.1%		
Explicitly link the assignment with course goals or learning objectives	1 Not at All	159	8.8%	2.50	91	6.7%	2.50	131	7.1%	2.57	
	2 Occasionally	586	32.5%		497	36.7%		528	28.5%		
	3 Frequently	1058	58.7%		768	56.6%		1195	64.5%		**High/Med
Engage deeply with a significant challenge or question within your discipline	1 Not at All	296	16.4%	2.25	198	14.6%	2.25	207	11.2%	2.38	**High/Low
	2 Occasionally	770	42.7%		554	40.8%		741	40.0%		
	3 Frequently	739	40.9%		605	44.6%		904	48.8%		**High/Low
Write in the specific style or format of your discipline	1 Not at All	250	13.8%	2.41	185	13.7%	2.41	285	15.4%	2.38	
	2 Occasionally	564	31.2%		429	31.8%		579	31.3%		
	3 Frequently	994	55.0%		737	54.6%		984	53.2%		
Use research methods from your discipline in field or applied settings	1 Not at All	350	19.4%	2.25	250	18.4%	2.26	309	16.7%	2.34	
	2 Occasionally	662	36.7%		504	37.2%		609	33.0%		
	3 Frequently	793	43.9%		602	44.4%		930	50.3%		*High/Med, **High/Low
Apply learning from both academic and field settings	1 Not at All	438	24.3%	2.18	340	25.1%	2.16	401	21.7%	2.25	
	2 Occasionally	610	33.9%		453	33.5%		590	32.0%		
	3 Frequently	754	41.8%		560	41.4%		855	46.3%		*High/Med
Describe how different perspectives would affect the interpretation of a question or issue in your discipline	1 Not at All	544	30.2%	1.96	440	32.4%	1.93	529	28.7%	2.00	
	2 Occasionally	781	43.4%		575	42.4%		784	42.5%		
	3 Frequently	474	26.3%		341	25.1%		533	28.9%		
Weigh the meaning and significance of evidence	1 Not at All	219	12.1%	2.43	158	11.7%	2.45	233	12.6%	2.44	
	2 Occasionally	587	32.5%		427	31.5%		574	30.9%		
	3 Frequently	998	55.3%		769	56.8%		1048	56.5%		
Provide feedback on drafts or work still in progress	1 Not at All	246	13.6%	2.25	184	13.6%	2.22	284	15.3%	2.21	
	2 Occasionally	864	47.8%		686	50.8%		891	48.0%		
	3 Frequently	696	38.5%		481	35.6%		682	36.7%		
Grading on a curve	1 None	1012	56.8%	1.74	691	51.9%	1.84	919	50.2%	1.94	**Low/High
	2 Some	406	22.8%		315	23.6%		394	21.5%		
	3 Most	175	9.8%		173	13.0%		238	13.0%		
	4 All	190	10.7%		153	11.5%		281	15.3%		
	All/Most (Percentages combined)		21.3%			24.5%			28.3%		**Low/High
Rubric-based assessment	1 None	334	18.8%	2.63	249	18.8%	2.57	407	22.2%	2.56	
	2 Some	483	27.2%		413	31.1%		467	25.5%		
	3 Most	468	26.3%		331	24.9%		472	25.8%		
	4 All	492	27.7%		335	25.2%		484	26.4%		

	All/Most (Percentages combined)		54.0%			50.2%			52.2%		
Class discussions	1 None	151	8.4%		87	6.4%		92	4.9%		
	2 Some	454	25.3%		339	25.1%		419	22.5%		
	3 Most	458	25.5%	2.99	355	26.3%	3.04	410	22.0%	3.18	
	4 All	734	40.8%		570	42.2%		940	50.5%		
	All/Most (Percentages combined)		66.3%			68.5%			72.5%		**Low/High
Cooperative learning (small groups)	1 None	200	11.2%		137	10.1%		225	12.1%		
	2 Some	577	32.2%		414	30.6%		589	31.7%		
	3 Most	483	26.9%	2.75	389	28.7%	2.80	498	26.8%	2.73	
	4 All	533	29.7%		414	30.6%		545	29.3%		
	All/Most (Percentages combined)		56.7%			59.3%			56.2%		
Experiential learning/Field studies	1 None	704	39.4%		544	40.4%		711	38.4%		
	2 Some	520	29.1%		385	28.6%		542	29.3%		
	3 Most	315	17.6%	2.06	237	17.6%	2.04	312	16.9%	2.09	
	4 All	247	13.8%		181	13.4%		285	15.4%		
	All/Most (Percentages combined)		31.5%			31.0%			32.3%		
Performances/Demonstrations	1 None	627	35.1%		461	34.1%		686	37.0%		
	2 Some	539	30.2%		434	32.1%		529	28.5%		
	3 Most	376	21.0%	2.13	264	19.5%	2.14	354	19.1%	2.13	
	4 All	245	13.7%		193	14.3%		287	15.5%		
	All/Most (Percentages combined)		34.8%			33.8%			34.5%		
Group projects	1 None	333	18.6%		199	14.7%		338	18.2%		
	2 Some	639	35.7%		474	35.0%		651	35.0%		
	3 Most	465	25.9%	2.47	341	25.2%	2.61	476	25.6%	2.50	
	4 All	355	19.8%		340	25.1%		394	21.2%		
	All/Most (Percentages combined)		45.8%			50.3%			46.8%		
Student-selected topics for course content	1 None	682	38.0%		512	37.9%		668	36.0%		
	2 Some	826	46.0%		598	44.3%		812	43.7%		
	3 Most	184	10.3%	1.84	150	11.1%	1.87	231	12.4%	1.92	
	4 All	103	5.7%		90	6.7%		146	7.9%		
	All/Most (Percentages combined)		16.0%			17.8%			20.3%		*Low/High
Reflective writing/journaling	1 None	972	54.3%		718	53.2%		1084	58.5%		
	2 Some	511	28.6%		402	29.8%		450	24.3%		
	3 Most	174	9.7%	1.70	138	10.2%	1.70	191	10.3%	1.66	
	4 All	132	7.4%		91	6.7%		129	7.0%		
	All/Most (Percentages combined)		17.1%			17.0%			17.3%		
Using real-life problems	1 None	85	4.7%		48	3.5%		108	5.8%		

	2 Some	338	18.8%	3.21	274	20.3%	3.22	356	19.1%	3.18	
	3 Most	489	27.2%		365	27.0%		491	26.4%		
	4 All	886	49.3%		666	49.2%		905	48.7%		
	All/Most (Percentages combined)		76.5%			76.2%			75.1%		
Using student inquiry to drive learning	1 None	188	10.5%	2.68	126	9.3%	2.72	205	11.1%	2.65	
	2 Some	647	36.1%		489	36.2%		669	36.1%		
	3 Most	500	27.9%		377	27.9%		542	29.2%		
	4 All	458	25.5%		357	26.5%		439	23.7%		
	All/Most (Percentages combined)		53.4%			54.4%			52.9%		
Student presentations	1 None	306	17.2%	2.43	197	14.7%	2.48	264	14.3%	2.52	
	2 Some	712	39.9%		544	40.7%		718	39.0%		
	3 Most	454	25.4%		351	26.3%		492	26.7%		
	4 All	312	17.5%		244	18.3%		367	19.9%		
	All/Most (Percentages combined)		42.9%			44.5%			46.7%		
"Learn before lecture" through multimedia tools (e.g., flipping the classroom)	1 None	767	43.2%	1.86	567	42.4%	1.87	765	41.7%	1.90	
	2 Some	645	36.3%		491	36.8%		655	35.7%		
	3 Most	208	11.7%		163	12.2%		242	13.2%		
	4 All	157	8.8%		115	8.6%		173	9.4%		
	All/Most (Percentages combined)		20.5%			20.8%			22.6%		
Techniques to create an inclusive classroom environment for diverse students	1 None	486	27.3%	2.37	338	25.5%	2.46	514	28.0%	2.36	
	2 Some	523	29.4%		365	27.5%		527	28.8%		
	3 Most	396	22.3%		304	22.9%		406	22.1%		
	4 All	374	21.0%		319	24.1%		386	21.1%		
	All/Most (Percentages combined)		43.3%			47.0%			43.2%		
I try to dispel perceptions of competition	1 Disagree Strongly	76	4.2%	3.02	51	3.8%	3.06	70	3.8%	3.00	
	2 Disagree Somewhat	363	20.3%		248	18.3%		393	21.3%		
	3 Agree Somewhat	808	45.1%		625	46.2%		840	45.6%		
	4 Agree Strongly	545	30.4%		430	31.8%		538	29.2%		
	Somewhat agree/ Strongly agree (Percentages combined)		75.5%			77.9%			74.9%		
All students have the potential to excel in my courses	1 Disagree Strongly	32	1.8%	3.42	22	1.6%	3.42	26	1.4%	3.50	
	2 Disagree Somewhat	177	9.8%		137	10.1%		159	8.6%		
	3 Agree Somewhat	604	33.4%		449	33.0%		536	28.8%		
	4 Agree Strongly	997	55.1%		753	55.3%		1138	61.2%		
	Somewhat agree/ Strongly agree (Percentages combined)		88.5%			88.3%			90.0%		
It is primarily up to individual students whether they succeed in my courses	1 Disagree Strongly	23	1.3%		26	1.9%		35	1.9%		
	2 Disagree Somewhat	142	7.8%		108	7.9%		167	9.0%		

my courses	3 Agree Somewhat	923	50.9%	3.30	682	50.1%	3.28	932	50.0%	3.26	
	4 Agree Strongly	726	40.0%		545	40.0%		730	39.2%		
	Somewhat agree/ Strongly agree (Percentages combined)		90.9%			90.2%			89.2%		
This institution takes responsibility for educating underprepared students	1 Disagree Strongly	125	7.1%	2.73	109	8.2%	2.70	131	7.2%	2.68	
	2 Disagree Somewhat	487	27.5%		399	29.9%		583	31.9%		
	3 Agree Somewhat	899	50.7%		610	45.7%		857	46.8%		
	4 Agree Strongly	261	14.7%		216	16.2%		259	14.2%		
	Somewhat agree/ Strongly agree (Percentages combined)		65.5%			61.9%			61.0%		*Low/High
There is adequate support for faculty development	1 Disagree Strongly	222	12.3%	2.66	160	11.8%	2.74	198	10.6%	2.77	
	2 Disagree Somewhat	476	26.4%		330	24.3%		451	24.2%		
	3 Agree Somewhat	798	44.3%		568	41.8%		793	42.6%		
	4 Agree Strongly	305	16.9%		300	22.1%		419	22.5%		
	Somewhat agree/ Strongly agree (Percentages combined)		61.2%			63.9%			65.1%		
My teaching is valued by faculty in my department	1 Disagree Strongly	55	3.1%	3.42	51	3.8%	3.43	61	3.3%	3.36	
	2 Disagree Somewhat	134	7.4%		99	7.3%		173	9.3%		
	3 Agree Somewhat	619	34.3%		430	31.6%		654	35.2%		
	4 Agree Strongly	995	55.2%		779	57.3%		972	52.3%		
	Somewhat agree/ Strongly agree (Percentages combined)		89.5%			89.0%			87.4%		
Develop a sense of community among students and faculty	1 Low Priority	124	6.9%	2.81	100	7.4%	2.82	171	9.2%	2.70	
	2 Medium Priority	471	26.0%		307	22.7%		530	28.6%		
	3 High Priority	844	46.6%		677	50.1%		835	45.1%		
	4 Highest Priority	371	20.5%		267	19.8%		315	17.0%		
	High/Highest (Percentages combined)		67.1%			69.9%			62.1%		**High/Med, *High Low
Structure your courses so that students master a conceptual understanding of course content	1 Not at All	22	1.2%	2.78	12	.9%	2.81	18	1.0%	2.79	
	2 To Some Extent	358	19.9%		238	17.5%		353	19.1%		
	3 To a Great Extent	1419	78.9%		1111	81.6%		1477	79.9%		
Help students evaluate the quality and reliability of information	1 Not Important	262	14.7%	2.58	202	14.9%	2.61	303	16.4%	2.53	
	2 Somewhat Important	558	31.3%		388	28.7%		585	31.8%		
	3 Very Important	632	35.4%		500	36.9%		628	34.1%		
	4 Essential	333	18.7%		264	19.5%		326	17.7%		
	Essential/Very Important (Percentages combined)		54.1%			56.4%			51.8%		
Stress: Committee work	1 Not Applicable	140	7.7%	2.58	78	5.8%	2.62	81	4.3%	2.63	
	2 Not at All	670	37.0%		503	37.1%		714	38.2%		
	3 Somewhat	805	44.5%		628	46.3%		885	47.3%		
	4 Extensive	196	10.8%		146	10.8%		190	10.2%		

Stress: Students	1 Not Applicable	23	1.3%	2.70	6	.4%	2.70	15	.8%	2.66	
	2 Not at All	637	35.2%		491	36.2%		728	39.0%		
	3 Somewhat	1009	55.7%		761	56.1%		993	53.2%		
	4 Extensive	142	7.8%		99	7.3%		132	7.1%		
Stress: Teaching load	1 Not Applicable	54	3.0%	2.76	20	1.5%	2.79	33	1.8%	2.73	
	2 Not at All	630	34.8%		472	34.8%		700	37.4%		
	3 Somewhat	818	45.2%		641	47.2%		880	47.1%		
	4 Extensive	307	17.0%		224	16.5%		257	13.7%		*Low/High
Stress: Lack of personal time	1 Not Applicable	16	.9%	3.02	8	.6%	3.03	9	.5%	2.99	
	2 Not at All	440	24.3%		324	23.9%		490	26.2%		
	3 Somewhat	852	47.0%		638	47.1%		889	47.5%		
	4 Extensive	505	27.9%		386	28.5%		483	25.8%		
Stress: Working with underprepared students	1 Not Applicable	37	2.0%	2.76	27	2.0%	2.69	43	2.3%	2.63	
	2 Not at All	574	31.7%		472	34.8%		754	40.3%		*Med/High, **Low/High
	3 Somewhat	991	54.8%		750	55.2%		917	49.1%		
	4 Extensive	208	11.5%		109	8.0%		155	8.3%		
Stress: Self-imposed High expectations	1 Not Applicable	16	.9%	3.17	7	.5%	3.18	11	.6%	3.18	
	2 Not at All	266	14.7%		191	14.1%		275	14.7%		
	3 Somewhat	931	51.4%		708	52.1%		959	51.2%		
	4 Extensive	598	33.0%		452	33.3%		629	33.6%		
How many courses are you teaching this term (include all institutions at which you teach) (e.g., 0,1,2,3)?	1 0 to 2	913	50.0%	1.59	767	56.1%	1.50	1197	63.6%	1.43	**Low/High, **Med/High
	2 3 to 4	751	41.1%		517	37.8%		562	29.9%		
	3 5+	163	8.9%		84	6.1%		122	6.5%		
Hours per Week: Preparing for teaching (including reading student papers and grading)	1 None to 4	351	19.3%	1.44	239	17.5%	2.19	496	26.4%	2.01	**Low/High, **Med/High
	2 5 to 12	794	43.6%		627	45.9%		862	45.9%		
	3 13+	678	37.2%		500	36.6%		521	27.7%		
Participated in organized activities around enhancing pedagogy and student learning	1 No	666	37.0%	1.63	508	37.6%	1.62	739	39.5%	1.60	
	2 Yes	1135	63.0%		844	62.4%		1131	60.5%		
Applied to internal grants for research	1 Not Available	115	6.3%	3.12	43	3.2%	3.28	64	3.4%	3.26	
	2 Not Eligible	125	6.9%		87	6.4%		95	5.1%		
	3 No	1004	55.2%		683	50.2%		1009	53.8%		
	4 Yes	574	31.6%		548	40.3%		708	37.7%		
Engaged undergraduates on your research project	1 No	815	45.0%	1.55	491	36.2%	1.64	644	34.3%	1.66	
	2 Yes	996	55.0%		864	63.8%		1231	65.7%		**Low/High
Worked with undergraduates on a research project	1 No	599	33.0%	1.67	385	28.3%	1.72	521	27.9%	1.72	
	2 Yes	1218	67.0%		976	71.7%		1348	72.1%		*Low/High
Presented with undergraduate students at conferences	1 Not at All	1059	59.6%	1.52	730	54.3%	1.61	1026	55.6%	1.58	
	2 To Some Extent	510	28.7%		409	30.4%		560	30.4%		
	3 To a Great Extent	207	11.7%		206	15.3%		258	14.0%		
Published with undergraduates	1 Not at All	1286	72.7%		854	63.7%		1097	59.7%		**Low/High

	2 To Some Extent	364	20.6%	1.34	353	26.3%	1.46	549	29.9%	1.51	
	3 To a Great Extent	118	6.7%		134	10.0%		193	10.5%		
Publish: Articles in academic or professional journals	1 None	382	21.0%		218	16.1%		245	13.0%		**Low/High
	2 1-2	316	17.4%		224	16.5%		238	12.7%		
	3 3-4	231	12.7%		141	10.4%		162	8.6%		
	4 5-10	310	17.1%	3.49	231	17.0%	3.80	279	14.8%	4.33	
	5 11-20	226	12.5%		228	16.8%		273	14.5%		
	6 21-50	192	10.6%		194	14.3%		331	17.6%		
	7 51+	158	8.7%		119	8.8%		351	18.7%		
Publish: Chapters in edited volumes	1 None	1096	61.6%		809	60.6%		917	49.4%		**Med/High, Low/High
	2 1-2	423	23.8%		307	23.0%		440	23.7%		
	3 3-4	130	7.3%		119	8.9%		229	12.3%		
	4 5-10	84	4.7%	1.64	71	5.3%	1.66	160	8.6%	2.01	
	5 11-20	30	1.7%		20	1.5%		66	3.6%		
	6 21-50	13	.7%		7	.5%		41	2.2%		
	7 51+	4	.2%		2	.1%		5	.3%		
In the past two years, how many of your professional writings have been published or accepted for publication?	1 None	769	42.3%		493	36.2%		528	28.1%		*High/Med, Low/High
	2 1-2	530	29.1%		433	31.8%		475	25.3%		
	3 3-4	236	13.0%	2.08	224	16.5%	2.16	327	17.4%	2.63	
	4 5-10	199	10.9%		161	11.8%		341	18.1%		
	5 11-20	68	3.7%		33	2.4%		126	6.7%		
	6 21+	18	1.0%		17	1.2%		82	4.4%		

Note: Latino efficiency means that efficiency scores were based on the production of STEM degrees by Latino students seeking a STEM degree.

p < .05; **p < .01

Table 6. Descriptive Statistics for Black Efficiency Percentages Distributed by Group for Variables of Interest

		"Low" Efficiency Institutions (N= 73 Institutions; 1882 faculty)			"Medium" Efficiency Institutions (N= 77 Institutions; 1622 faculty)			"High" Efficiency Institutions (N= 76 Institutions; 1596 faculty)			
		Count	Column Valid N %	Mean Score	Count	Column Valid N %	Mean Score	Count	Column Valid N %	Mean Score	Significant Differences Between Efficiency Groups
Provide instructions clearly delineating what students are to do to complete the assignment	1 Not at All	24	1.3%	2.87	34	2.1%	2.84	20	1.3%	2.88	
	2 Occasionally	196	10.6%		180	11.3%		141	9.0%		
	3 Frequently	1632	88.1%		1383	86.6%		1412	89.8%		*Med/High
Explicitly link the assignment with course goals or learning objectives	1 Not at All	139	7.5%	2.53	129	8.1%	2.49	116	7.4%	2.56	
	2 Occasionally	593	32.1%		560	35.1%		457	29.1%		
	3 Frequently	1114	60.3%		905	56.8%		995	63.5%		**Med/High
Engage deeply with a significant challenge or question within your discipline	1 Not at All	259	14.0%	2.31	248	15.5%	2.26	190	12.2%	2.35	
	2 Occasionally	751	40.6%		680	42.5%		633	40.5%		
	3 Frequently	838	45.3%		671	42.0%		740	47.3%		*Med/High
Write in the specific style or format of your discipline	1 Not at All	*274*	14.8%	2.39	222	13.9%	2.39	217	13.9%	2.43	
	2 Occasionally	578	31.3%		533	33.5%		459	29.4%		
	3 Frequently	996	53.9%		838	52.6%		885	56.7%		
Use research methods from your discipline in field or applied settings	1 Not at All	333	18.0%	2.29	285	17.8%	2.27	286	18.3%	2.29	
	2 Occasionally	653	35.3%		592	37.1%		540	34.6%		
	3 Frequently	862	46.6%		720	45.1%		733	47.0%		
Apply learning from both academic and field settings	1 Not at All	460	24.9%	2.16	409	25.6%	2.14	305	19.6%	2.30	
	2 Occasionally	632	34.3%		559	35.0%		473	30.4%		
	3 Frequently	753	40.8%		628	39.3%		777	50.0%		**Med/High, **Low/High
Describe how different perspectives would affect the interpretation of a question or issue in your discipline	1 Not at All	590	31.9%	1.94	501	31.5%	1.93	427	27.4%	2.04	*Low/High
	2 Occasionally	782	42.3%		707	44.4%		645	41.5%		
	3 Frequently	475	25.7%		385	24.2%		484	31.1%		**Med/High, *Low/High
Weigh the meaning and significance of evidence	1 Not at All	205	11.1%	2.46	223	13.9%	2.42	177	11.3%	2.46	
	2 Occasionally	592	32.1%		490	30.6%		494	31.6%		
	3 Frequently	1046	56.8%		889	55.5%		890	57.0%		
Provide feedback on drafts or work still in progress	1 Not at All	257	13.9%	2.22	223	14.0%	2.22	219	14.0%	2.26	
	2 Occasionally	927	50.2%		799	50.2%		720	45.9%		
	3 Frequently	663	35.9%		571	35.8%		630	40.2%		
Grading on a curve	1 None	920	50.6%	1.90	836	53.2%	1.81	862	55.4%	1.79	
	2 Some	408	22.4%		373	23.7%		345	22.2%		
	3 Most	237	13.0%		181	11.5%		168	10.8%		
	4 All	254	14.0%		182	11.6%		180	11.6%		
	All/Most (Percentages combined)	491	27.0%		363	23.1%		348	22.4%		
Rubric-based assessment	1 None	391	21.6%		329	21.0%		266	17.1%		
	2 Some	548	30.2%		448	28.5%		382	24.6%		

	3 Most	441	24.3%	2.51	386	24.6%	2.55	439	28.3%	2.71	
	4 All	433	23.9%		407	25.9%		466	30.0%		
	All/Most (Percentages combined)		48.2%			50.5%			58.3%		**Med/High, **Low/High
Class discussions	1 None	101	5.5%		125	7.9%		103	6.6%		
	2 Some	447	24.2%		397	25.0%		372	23.7%		
	3 Most	464	25.2%	3.10	409	25.7%	3.01	342	21.8%	3.11	
	4 All	832	45.1%		660	41.5%		751	47.9%		
	All/Most (Percentages combined)		70.3%			67.2%			69.7%		
Cooperative learning (small groups)	1 None	203	11.0%		179	11.3%		176	11.2%		
	2 Some	585	31.7%		478	30.1%		509	32.5%		
	3 Most	509	27.6%	2.76	466	29.3%	2.77	404	25.8%	2.76	
	4 All	547	29.7%		466	29.3%		478	30.5%		
	All/Most (Percentages combined)		57.3%			58.7%			56.3%		
Experiential learning/Field studies	1 None	716	39.0%		648	41.0%		587	37.5%		
	2 Some	555	30.2%		448	28.4%		448	28.6%		
	3 Most	329	17.9%	2.05	247	15.6%	2.04	290	18.5%	2.12	
	4 All	235	12.8%		236	14.9%		239	15.3%		
	All/Most (Percentages combined)		30.7%			30.6%			33.8%		
Performances/Demonstrations	1 None	640	34.8%		539	34.1%		587	37.4%		
	2 Some	559	30.4%		505	31.9%		445	28.4%		
	3 Most	369	20.1%	2.15	318	20.1%	2.14	309	19.7%	2.11	
	4 All	272	14.8%		220	13.9%		227	14.5%		
	All/Most (Percentages combined)		34.8%			34.0%			34.2%		
Group projects	1 None	321	17.4%		264	16.6%		279	17.8%		
	2 Some	647	35.1%		536	33.7%		568	36.3%		
	3 Most	462	25.1%	2.53	457	28.7%	2.54	381	24.3%	2.50	
	4 All	414	22.5%		334	21.0%		338	21.6%		
	All/Most (Percentages combined)		47.5%			49.7%			45.9%		
Student-selected topics for course content	1 None	664	36.0%		591	37.2%		596	38.0%		
	2 Some	850	46.1%		743	46.8%		659	42.0%		
	3 Most	205	11.1%	1.89	165	10.4%	1.84	186	11.9%	1.90	
	4 All	125	6.8%		88	5.5%		127	8.1%		
	All/Most (Percentages combined)		17.9%			15.9%			20.0%		
Reflective writing/journaling	1 None	1040	56.6%		887	56.1%		835	53.2%		
	2 Some	501	27.2%		458	29.0%		426	27.1%		
	3 Most	167	9.1%	1.67	142	9.0%	1.65	183	11.7%	1.75	

	4 All	131	7.1%		93	5.9%		126	8.0%		
	All/Most (Percentages combined)		16.2%			14.9%			19.7%		*High/Med
Using real-life problems	1 None	92	5.0%		72	4.5%		72	4.6%		
	2 Some	344	18.6%		325	20.5%		301	19.1%		
	3 Most	505	27.3%	3.20	450	28.3%	3.17	393	25.0%	3.23	
	4 All	906	49.1%		741	46.7%		806	51.3%		
	All/Most (Percentages combined)		76.4%			75.0%			76.3%		
Using student inquiry to drive learning	1 None	188	10.2%		146	9.2%		181	11.6%		
	2 Some	671	36.4%		582	36.7%		544	34.7%		
	3 Most	519	28.2%	2.68	470	29.7%	2.69	447	28.5%	2.67	
	4 All	463	25.1%		387	24.4%		395	25.2%		
	All/Most (Percentages combined)		53.3%			54.1%			53.7%		
Student presentations	1 None	269	14.7%		227	14.4%		264	17.0%		
	2 Some	745	40.8%		655	41.5%		576	37.0%		
	3 Most	484	26.5%	2.48	426	27.0%	2.47	386	24.8%	2.50	
	4 All	329	18.0%		269	17.1%		330	21.2%		
	All/Most (Percentages combined)		44.5%			44.1%			46.0%		
"Learn before lecture" through multimedia tools (e.g., flipping the classroom)	1 None	815	44.7%		654	41.6%		622	40.1%		
	2 Some	630	34.6%		602	38.3%		572	36.8%		
	3 Most	214	11.7%	1.85	195	12.4%	1.86	205	13.2%	1.93	
	4 All	163	8.9%		120	7.6%		154	9.9%		
	All/Most (Percentages combined)		20.7%			20.1%			23.1%		
Techniques to create an inclusive classroom environment for diverse students	1 None	495	27.2%		425	27.1%		404	26.1%		
	2 Some	557	30.6%		440	28.1%		421	27.2%		
	3 Most	414	22.7%	2.35	333	21.3%	2.41	360	23.2%	2.44	
	4 All	356	19.5%		369	23.5%		364	23.5%		
	All/Most (Percentages combined)		42.3%			44.8%			46.7%		
I try to dispel perceptions of competition	1 Disagree Strongly	70	3.8%		62	3.9%		62	4.0%		
	2 Disagree Somewhat	390	21.1%		313	19.8%		301	19.4%		
	3 Agree Somewhat	845	45.8%		698	44.1%		727	46.8%		
	4 Agree Strongly	541	29.3%	3.01	509	32.2%	3.05	463	29.8%	3.02	
	Somewhat agree/ Strongly agree (Percentages combined)		75.1%			76.3%			76.6%		
All students have the potential to excel in my courses	1 Disagree Strongly	24	1.3%		20	1.3%		33	2.1%		
	2 Disagree Somewhat	190	10.2%		163	10.2%		121	7.7%		
	3 Agree Somewhat	590	31.8%		554	34.8%		454	28.8%		

	4 Agree Strongly	1054	56.7%	3.44	857	53.8%	3.41	966	61.4%	3.49	
	Somewhat agree/ Strongly agree (Percentages combined)		88.5%			88.5%			90.2%		
It is primarily up to individual students whether they succeed in my courses	1 Disagree Strongly	33	1.8%		25	1.6%		26	1.7%		
	2 Disagree Somewhat	146	7.8%		133	8.3%		139	8.8%		
	3 Agree Somewhat	905	48.6%		811	50.7%		829	52.7%		
	4 Agree Strongly	778	41.8%	3.30	631	39.4%	3.28	579	36.8%	3.25	
	Somewhat agree/ Strongly agree (Percentages combined)		90.4%			90.1%			89.5%		
This institution takes responsibility for educating underprepared students	1 Disagree Strongly	130	7.1%		125	8.0%		111	7.3%		
	2 Disagree Somewhat	556	30.4%		460	29.3%		452	29.5%		
	3 Agree Somewhat	878	48.0%		741	47.1%		739	48.3%		
	4 Agree Strongly	264	14.4%	2.70	246	15.6%	2.70	229	15.0%	2.71	
	Somewhat agree/ Strongly agree (Percentages combined)		62.5%			62.8%			63.2%		
There is adequate support for faculty development	1 Disagree Strongly	177	9.6%		189	11.9%		197	12.5%		
	2 Disagree Somewhat	431	23.3%		387	24.3%		439	27.9%		
	3 Agree Somewhat	812	43.9%		680	42.7%		678	43.0%		
	4 Agree Strongly	430	23.2%	2.81	335	21.1%	2.73	261	16.6%	2.64	
	Somewhat agree/ Strongly agree (Percentages combined)		67.1%			63.8%			59.6%		**Low/High
My teaching is valued by faculty in my department	1 Disagree Strongly	55	3.0%		54	3.4%		48	3.1%		
	2 Disagree Somewhat	166	8.9%		115	7.2%		125	8.0%		
	3 Agree Somewhat	627	33.7%		507	31.9%		570	36.3%		
	4 Agree Strongly	1010	54.4%	3.40	912	57.4%	3.43	827	52.7%	3.39	
	Somewhat agree/ Strongly agree (Percentages combined)		88.1%			89.4%			89.0%		
Institutional Priority: Develop a sense of community among students and faculty	1 Low Priority	137	7.4%		117	7.3%		142	9.1%		
	2 Medium Priority	485	26.2%		406	25.5%		408	26.1%		
	3 High Priority	911	49.2%	2.76	741	46.5%	2.80	710	45.4%	2.75	
	4 Highest Priority	319	17.2%		329	20.7%		304	19.4%		
	High/Highest (Percentages combined)		66.4%			67.2%			64.8%		
Structure your courses so that students master a conceptual understanding of course content	1 Not at All	18	1.0%		16	1.0%		17	1.1%		
	2 To Some Extent	355	19.2%	2.79	313	19.7%	2.78	282	18.0%	2.80	
	3 To a Great Extent	1474	79.8%		1261	79.3%		1267	80.9%		
Help students evaluate the quality and reliability of information	1 Not Important	270	14.6%		235	14.9%		266	17.2%		
	2 Somewhat Important	571	30.9%		495	31.4%		461	29.8%		

	3 Very Important	664	35.9%	2.59	596	37.8%	2.55	508	32.8%	2.56	
	4 Essential	344	18.6%		252	16.0%		314	20.3%		
	Essential/Very Important (Percentages combined)		54.5%			53.7%			53.1%		
Stress: Committee work	1 Not Applicable	107	5.8%	2.60	109	6.8%	2.59	83	5.3%	2.65	
	2 Not at All	727	39.3%		592	37.0%		560	35.5%		
	3 Somewhat	820	44.3%		740	46.2%		756	47.9%		
	4 Extensive	198	10.7%		160	10.0%		178	11.3%		
Stress: Students	1 Not Applicable	9	.5%	2.68	18	1.1%	2.70	17	1.1%	2.70	
	2 Not at All	717	38.7%		559	34.9%		565	35.9%		
	3 Somewhat	989	53.4%		916	57.2%		865	54.9%		
	4 Extensive	138	7.4%		108	6.7%		129	8.2%		
Stress: Teaching load	1 Not Applicable	24	1.3%	2.74	50	3.1%	2.79	29	1.8%	2.75	
	2 Not at All	713	38.4%		513	32.0%		573	36.4%		
	3 Somewhat	842	45.3%		766	47.8%		733	46.6%		
	4 Extensive	278	15.0%		272	17.0%		238	15.1%		
Stress: Lack of personal time	1 Not Applicable	9	.5%	3.01	13	.8%	3.05	9	.6%	2.99	
	2 Not at All	479	25.8%		361	22.5%		410	26.0%		
	3 Somewhat	857	46.1%		765	47.8%		744	47.3%		
	4 Extensive	515	27.7%		462	28.9%		411	26.1%		
Stress: Working with underprepared students	1 Not Applicable	35	1.9%	2.63	30	1.9%	2.73	40	2.5%	2.74	
	2 Not at All	744	40.1%		522	32.6%		526	33.4%		**Low/High
	3 Somewhat	944	50.8%		897	56.1%		819	52.0%		
	4 Extensive	134	7.2%		150	9.4%		190	12.1%		
Stress: Self-imposed High expectations	1 Not Applicable	11	.6%	3.18	12	.7%	3.18	10	.6%	3.17	
	2 Not at All	276	14.8%		212	13.2%		240	15.2%		
	3 Somewhat	940	50.5%		853	53.2%		800	50.8%		
	4 Extensive	634	34.1%		525	32.8%		525	33.3%		
How many courses are you teaching this term (include all institutions at which you teach) (e.g., 0,1,2,3)?	1 0 to 2	1129	60.2%	1.46	874	54.1%	1.55	867	54.9%	1.52	*Low/High
	2 3 to 4	626	33.4%		599	37.1%		603	38.2%		
	3 5+	121	6.4%		143	8.8%		109	6.9%		
Hours per Week: Preparing for teaching (including reading student papers and grading)	1 None to 4	413	22.1%	2.09	293	18.2%	2.20	367	23.2%	2.09	*Med/High
	2 5 to 12	869	46.4%		710	44.0%		710	45.0%		
	3 13+	589	31.5%		609	37.8%		502	31.8%		
Participated in organized activities around enhancing pedagogy and student learning	1 No	715	38.4%	1.62	606	38.1%	1.62	577	36.8%	1.63	
	2 Yes	1146	61.6%		983	61.9%		991	63.2%		
Applied to internal grants for research	1 Not Available	60	3.2%	3.28	73	4.5%	3.21	88	5.6%	3.15	
	2 Not Eligible	120	6.4%		98	6.1%		86	5.5%		
	3 No	922	49.4%		859	53.5%		906	57.5%		
	4 Yes	766	41.0%		575	35.8%		496	31.5%		**Low/High

Engaged undergraduates on your research project	1 No	613	32.9%	1.67	627	39.2%	1.61	697	44.2%	1.56	
	2 Yes	1250	67.1%		972	60.8%		880	55.8%		*Med/High, **Low/High
Worked with undergraduates on a research project	1 No	459	24.6%	1.75	447	28.0%	1.72	577	36.5%	1.63	
	2 Yes	1408	75.4%		1151	72.0%		1002	63.5%		**Med/High, **Low/High
Presented with undergraduate students at conferences	1 Not at All	959	52.2%	1.64	885	56.0%	1.59	946	61.2%	1.49	*Med/High, **Low/High
	2 To Some Extent	572	31.2%		461	29.2%		445	28.8%		
	3 To a Great Extent	305	16.6%		233	14.8%		155	10.0%		
Published with undergraduates	1 Not at All	1076	58.8%	1.54	1038	65.9%	1.43	1109	72.1%	1.34	**Med/High, **Low/High
	2 To Some Extent	523	28.6%		404	25.7%		343	22.3%		
	3 To a Great Extent	231	12.6%		133	8.4%		87	5.7%		
Publish: Articles in academic or professional journals	1 None	270	14.5%	4.08	295	18.4%	3.68	280	17.7%	3.85	
	2 1-2	265	14.2%		279	17.4%		237	15.0%		
	3 3-4	186	10.0%		158	9.9%		180	11.4%		
	4 5-10	297	15.9%		285	17.8%		248	15.7%		
	5 11-20	300	16.1%		234	14.6%		203	12.9%		
	6 21-50	280	15.0%		193	12.0%		239	15.1%		
	7 51+	269	14.4%		158	9.9%		192	12.2%		
Publish: Chapters in edited volumes	1 None	1010	54.8%	1.85	953	60.7%	1.68	866	55.7%	1.81	*Med/High
	2 1-2	442	24.0%		356	22.7%		369	23.7%		
	3 3-4	175	9.5%		141	9.0%		159	10.2%		
	4 5-10	134	7.3%		73	4.6%		105	6.7%		
	5 11-20	45	2.4%		32	2.0%		38	2.4%		
	6 21-50	33	1.8%		13	.8%		15	1.0%		
	7 51+	4	.2%		3	.2%		4	.3%		
In the past two years, how many of your professional writings have been published or accepted for publication?	1 None	605	32.3%	2.43	621	38.8%	2.15	555	35.1%	2.31	
	2 1-2	512	27.4%		486	30.4%		452	28.6%		
	3 3-4	315	16.8%		229	14.3%		243	15.4%		
	4 5-10	283	15.1%		188	11.7%		227	14.3%		
	5 11-20	101	5.4%		52	3.2%		71	4.5%		
	6 21+	56	3.0%		25	1.6%		34	2.1%		

Note: Black efficiency means that efficiency scores were based on the production of STEM degrees by Black students seeking a STEM degree.

$p < .05$; $^{**}p < .01$

Appendix A. Variables and Scale

Variable	Scale
In creating assignments for your courses, how often do you:	
Provide instructions clearly delineating what students are to do to complete the assignment	1=Not at all; 2=Occasionally; 3=Frequently
Explicitly link the assignment with course goals or learning objectives	1=Not at all; 2=Occasionally; 3=Frequently
Provide feedback on drafts or work still in progress	1=Not at all; 2=Occasionally; 3=Frequently
How frequently in the courses you taught in the past year have you given at least one assignment that required students to:	
Engage deeply with a significant challenge or question within your discipline	1=Not at all; 2=Occasionally; 3=Frequently
Write in the specific style or format of your discipline	1=Not at all; 2=Occasionally; 3=Frequently
Use research methods from your discipline in field or applied settings	1=Not at all; 2=Occasionally; 3=Frequently
Apply learning from both academic and field settings	1=Not at all; 2=Occasionally; 3=Frequently
Describe how different perspectives would affect the interpretation of a question or issue in your discipline	1=Not at all; 2=Occasionally; 3=Frequently
In how many of the courses that you teach do you use each of the following?	
Grading on a curve	1=None; 2=Some; 3=Most; 4=All
Rubric-based assessment	1=None; 2=Some; 3=Most; 4=All
Class discussions	1=None; 2=Some; 3=Most; 4=All
Cooperative learning (small groups)	1=None; 2=Some; 3=Most; 4=All
Experiential learning/Field studies	1=None; 2=Some; 3=Most; 4=All
Performances/Demonstrations	1=None; 2=Some; 3=Most; 4=All
Group projects	1=None; 2=Some; 3=Most; 4=All
Student-selected topics for course content	1=None; 2=Some; 3=Most; 4=All
Reflective writing/journaling	1=None; 2=Some; 3=Most; 4=All
Using real-life problems	1=None; 2=Some; 3=Most; 4=All
Using student inquiry to drive learning	1=None; 2=Some; 3=Most; 4=All
Student presentations	1=None; 2=Some; 3=Most; 4=All
“Learn before lecture” through multimedia tools (e.g., flipping the classroom)	1=None; 2=Some; 3=Most; 4=All
Techniques to create an inclusive classroom environment for diverse students	1=None; 2=Some; 3=Most; 4=All
Indicate the extent to which you agree or disagree with each of the following:	
I try to dispel perceptions of competition	1=Disagree strongly 2=Disagree somewhat 3=Agree somewhat 4=Agree strongly
All students have the potential to excel in my courses	1=Disagree strongly 2=Disagree somewhat 3=Agree somewhat 4=Agree strongly
It is primarily up to individual students whether they succeed in my courses	1=Disagree strongly 2=Disagree somewhat 3=Agree somewhat 4=Agree strongly

This institution takes responsibility for educating underprepared students	1=Disagree strongly 2=Disagree somewhat 3=Agree somewhat 4=Agree strongly
There is adequate support for faculty development	1=Disagree strongly 2=Disagree somewhat 3=Agree somewhat 4=Agree strongly
My teaching is valued by faculty in my department	1=Disagree strongly 2=Disagree somewhat 3=Agree somewhat 4=Agree strongly

Indicate how important you believe each priority listed below is at your college or university:

Institutional Priority: Develop a sense of community among students and faculty	1=Low priority 2=Medium priority 3=High priority 4=Highest priority

Please indicate the extent to which you:

Structure your courses so that students master a conceptual understanding of course content	1=Not at all 2=To some extent 3=To a great extent

Indicate the importance to you of each of the following education goals for undergraduate students:

Help students evaluate the quality and reliability of information	1=Not important; 2=Somewhat important; 3=Very important; 4=Essential

Please indicate the extent to which each of the following has been a source of stress for you during the last two years:

Stress: Committee work	1=Not applicable; 2=Not at all; 3=Somewhat; 4=Extensive
Stress: Students	1=Not applicable; 2=Not at all; 3=Somewhat; 4=Extensive
Stress: Teaching load	1=Not applicable; 2=Not at all; 3=Somewhat; 4=Extensive
Stress: Lack of personal time	1=Not applicable; 2=Not at all; 3=Somewhat; 4=Extensive
Stress: Working with underprepared students	1=Not applicable; 2=Not at all; 3=Somewhat; 4=Extensive
Stress: Self-imposed high expectations	1=Not applicable; 2=Not at all; 3=Somewhat; 4=Extensive
How many courses are you teaching this term (include all institutions at which you teach) (e.g., 0,1,2,3)?	Continuous
Hours per Week: Preparing for teaching (including reading student papers and grading)	1=None; 2=1-4; 3=5-8; 4=9-12; 5=13-16; 6=17-20; 7=21+

During the past two years, have you engaged in any of the following activities? (Mark one for each item)

Participated in organized activities around enhancing pedagogy and student learning	1=Not available 2=Not eligible 3=No 4=Yes
Applied for Internal grants for research	1=Not available 2=Not eligible 3=No 4=Yes

To what extent do you:

Engaged undergraduates on your research project	1=Not at all 2=To some extent 3=To a great extent
Worked with undergraduates on a research project	1=Not at all 2=To some extent 3=To a great extent
Presented with undergraduate students at conferences	1=Not at all 2=To some extent 3=To a great extent
Published with undergraduates	1=Not at all 2=To some extent 3=To a great extent
How many of the following have you published?	
Published: Articles in academic or professional journals	1=None; 2=1-2; 3=3-4; 4=5-10; 5=11-20; 6=21-50; 7=51+
Published: Chapters in edited volumes	1=None; 2=1-2; 3=3-4; 4=5-10; 5=11-20; 6=21-50; 7=51+
In the past two years, how many of your professional writings have been published or accepted for publication?	1=None; 2=1-2; 3=3-4; 4=5-10; 5=11-20; 6=21+

Note: n=5952 STEM faculty across 265 institutions.

Appendix B. Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
Provide instructions clearly delineating what students are to do to complete the assignment	1	3	2.86	.393
Explicitly link the assignment with course goals or learning objectives	1	3	2.53	.632
Engage deeply with a significant challenge or question within your discipline	1	3	2.30	.700
Write in the specific style or format of your discipline	1	3	2.38	.733
Use research methods from your discipline in field or applied settings	1	3	2.28	.754
Apply learning from both academic and field settings	1	3	2.21	.790
Describe how different perspectives would affect the interpretation of a question or issue in your discipline	1	3	1.98	.754
Weigh the meaning and significance of evidence	1	3	2.44	.701
Provide feedback on drafts or work still in progress	1	3	2.24	.679
Grading on a curve	1	4	1.81	1.043
Rubric-based assessment	1	4	2.59	1.083
Class discussions	1	4	3.08	.974
Cooperative learning (small groups)	1	4	2.76	1.004
Experiential learning/Field studies	1	4	2.09	1.071
Performances/Demonstrations	1	4	2.15	1.060
Group projects	1	4	2.53	1.015
Student-selected topics for course content	1	4	1.89	.869
Reflective writing/journaling	1	4	1.69	.915
Using real-life problems	1	4	3.22	.908
Using student inquiry to drive learning	1	4	2.70	.965
Student presentations	1	4	2.49	.968
“Learn before lecture” through multimedia tools (e.g., flipping the classroom)	1	4	1.90	.953
Techniques to create an inclusive classroom environment for diverse students	1	4	2.40	1.100
I try to dispel perceptions of competition	1	4	3.02	.814
I encourage all students to approach me for help	1	4	3.92	.281
All students have the potential to excel in my courses	1	4	3.46	.723
It is primarily up to individual students whether they succeed in my courses	1	4	3.28	.687
This institution takes responsibility for educating underprepared students	1	4	2.70	.810
There is adequate support for faculty development	1	4	2.72	.915
My teaching is valued by faculty in my department	1	4	3.40	.772
Develop a sense of community among students and faculty	1	4	2.78	.843
Structure your courses so that students master a conceptual understanding of course content	1	3	2.78	.439
Help students evaluate the quality and reliability of information	1	4	2.58	.956
Committee work	1	4	2.62	.756
Students	1	4	2.69	.617
Teaching load	1	4	2.75	.742
Lack of personal time	1	4	3.01	.740

Working with underprepared students	1	4	2.70	.672
Self-imposed high expectations	1	4	3.17	.691
How many courses are you teaching this term (include all institutions at which you teach) (e.g., 0,1,2,3)? (20 maximum)	0	13	2.37	1.500
Hours per Week: Preparing for teaching (including reading student papers and grading)	1	7	3.84	1.689
Participated in organized activities around enhancing pedagogy and student learning	1	2	1.61	.487
Prof Develop: Internal grants for research	1	4	3.19	.759
Engaged undergraduates on your research project	1	2	1.60	.489
Worked with undergraduates on a research project	1	2	1.69	.462
Presented with undergraduate students at conferences	1	3	1.55	.714
Publish: Published with undergraduates	1	3	1.42	.642
Publish: Articles in academic or professional journals	1	7	3.84	2.014
Publish: Chapters in edited volumes	1	7	1.79	1.164
In the past two years, how many of your professional writings have been published or accepted for publication?	1	6	2.30	1.320

Note: n=5952 STEM faculty across 265 institutions.

Appendix C.

Factor Items and Loadings

Item	Factor Loading	R^2
Research-Teaching Nexus		
Engage deeply with a significant challenge or question within your discipline	0.65	0.43
Write in the specific style or format of your discipline	0.59	0.35
Use research methods from your discipline in field or applied settings	0.75	0.57
Apply learning from both academic and field settings	0.57	0.33
Describe how different perspectives would affect the interpretation of a question or issue in your discipline	0.68	0.46
Weigh the meaning and significance of evidence	0.64	0.41
Student-Centered Pedagogy		
Class discussions	0.63	0.40
Cooperative learning (small groups)	0.58	0.34
Experiential learning/Field studies	0.54	0.29
Performances/Demonstrations	0.48	0.23
Group projects	0.59	0.34
Student-selected topics for course content	0.51	0.26
Reflective writing/journaling	0.54	0.29
Using real-life problems	0.50	0.25
Using student inquiry to drive learning	0.58	0.34
Student presentations	0.63	0.40
Scholarly Productivity		
# of published articles in academic and professional journals	n/a	n/a
# of published chapters in edited volumes	n/a	n/a
# of professional writings published or accepted for publication in the last two years?	n/a	n/a

Note: n=5952 STEM faculty across 265 institutions.