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Disciplinary Differences in Faculty Members' Emphasis on Deep Approaches to Learning

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Abstract

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"Deep learning" is important in higher education because students who utilize such an approach tend to get more out of their educational experiences. As learning is a shared responsibility between students and faculty, it is equally important to examine how much faculty members emphasize deep approaches to learning as it is to assess how much students employ these approaches. This study examines disciplinary differences in faculty members' emphasis on deep approaches to learning. On average, faculty in education, arts and humanities, and social science fields emphasize deep learning more than their colleagues from other disciplinary areas, which is not entirely consistent with findings from a previous study on students.

Disciplinary Differences in Faculty Members' Emphasis on Deep Approaches to Learning

The phrase "deep processing" was first used by Marton and Säljö (1976), to describe qualitative distinctions in how students responded to a learning task. "Deep" approaches were seen as ideal, with students looking past the signs associated with information (surface approaches) to the more important underlying meaning (Marton and Säljö, 1976). As Ramsden (2003) stated, "Surface approaches have nothing to do with wisdom and everything to do with aimless accumulation. They belong to an artificial world of learning, where faithfully reproducing fragments of torpid knowledge to please teachers and pass examination has replaced understanding" (p.59).

Since the seminal work of Marton and Säljö, a large body of research has contributed to the perception of "deep" processing as a key component of an ideal learning environment. In particular, students who use deep approaches to learning tend to perform better as well as retain, integrate, and transfer information at higher rates than students using surface approaches to learning (Biggs 1988, 1989; Entwistle & Ramsden, 1983; Prosser & Millar, 1989; Ramsden, 2003; Whelan, 1988). Accordingly, deep learning is a concept of increasing interest to those assessing student engagement and learning in higher education.

Scholars (Biggs, 1987, 2003; Entwistle, 1981; Ramsden, 2003; Tagg, 2003) generally agree that deep learning is represented by a personal commitment to understand the material which is reflected in using various strategies such as reading widely, combining a variety of resources, discussion ideas with others, reflecting on how individual pieces of information relate to larger constructs or patterns, and applying knowledge in real world situations (Biggs, 1989). Also characteristic of deep learning is integrating and synthesizing information with prior learning in ways that become part of one's thinking and approaching new phenomena and efforts to see things from different perspectives (Ramsden, 2003; Tagg, 2003). By contrast, students using "surface-level processing" focus on the substance of information and emphasize rote learning and memorization techniques (Biggs, 1989; Tagg, 2003). With surface approaches, the goal of studying for a test or exam is to avoid failure, instead of grasping key concepts and understanding their relation to other information and how the information applies in other circumstances (Bowden & Marton, 1998).

Drawing from the findings of deep learning research, colleges and universities are paying increased attention to the benefits of student-centered approaches to teaching and learning. Faculty members are being encouraged to shift away from traditional pedagogical approaches that emphasize "surface level processing" (Biggs, 1989; Tagg, 2003). Faculty members are instead expected to foster learning environments that encourage students to grasp the underlying meaning of information, gaining a personal interest in the learning process. Recent data suggest that the increased emphasis on active, leaner-centered approaches has had a positive impact; for example, findings from the National Survey of Student Engagement (NSSE) (2000, 2001, 2002, 2003, 2004, 2005) indicate that a majority of undergraduates at four-year institutions engage in various forms of active and collaborative learning activities at least "sometimes" during a given academic year and that faculty are encouraging, and sometimes requiring, such engagement.

Research also supports that the learning context plays an important role in how students approach learning tasks (Beatie, Collins, & McInnes, 1997; Biggs, 1987; Biggs & Moore, 1993; Eley 1992; Gow, Kember & Cooper, 1994; Ramsden 2003; Tagg, 2003; Zeegers, 2001). Although choice of learning approach may be influenced by personal characteristics such as ability (Biggs, 1987), often the learning task itself and the conditions under which the task is performed affect which approach is utilized (Biggs, 1987; Ramsden, 2003). Thus, the interaction between a student and the course structure, curriculum content, and methods of teaching and assessment shapes whether a student will gravitate toward a surface or deep approach (Biggs, 1989; Entwistle & Ramsden, 1983). Without a doubt, faculty are a central component of the learning context and thus play an important role in student's learning approach.

If faculty and the educational environment influence the learning approaches utilized by students, it stands to reason that such approaches could vary among different fields of study (National Research Council, 1999; Zeegers, 2001). In exploring this issue, Nelson Laird, Shoup, & Kuh (2005) examined the degree to which undergraduate students across multiple disciplines engage in deep learning approaches. The study found differences in the utilization of deep approaches to learning across several disciplinary areas. In general, students in the arts and humanities as well as the social sciences were found to use deep approaches to learning to a greater extent than students in the physical sciences and engineering, with students in education and biological sciences at levels in between.

Since learning is a shared responsibility between students and instructors, it becomes important to examine how faculty practices within different disciplinary areas correspond with the learning approaches chosen by students. It may be convenient to assume that if engineering students, for example, report using deep approaches to learning less often than students in the social sciences, that the difference is attributable to deep learning activities being emphasized to similarly differing degrees by the faculty in those areas. However, it is entirely possible that faculty in those two areas value and emphasize deep approaches to learning equally or that engineering faculty value and emphasize these activities to a greater degree than their colleagues in the social sciences. While these latter possibilities would certainly complicate our understanding of disciplinary contexts, they should not simply be ignored.

As a way to frame and understand disciplinary differences, researchers examining variations in teaching have relied frequently on a disciplinary categorization created by Biglan (1973a,b) and further explicated by others (e.g., Becher & Trowler, 2001). While Biglan identified three dimensions, most focus on the first (hard-soft) and sometimes include the second (pure-applied). The third (life-non-life) is rarely used. Based on measures of faculty social connectedness and commitment to different areas of their work and later with characteristics of subject matter and departmental organization, Biglan developed and tested this three dimensional classification of fields of study. The hard-soft dimension distinguishes between fields with a high degree of consensus about the knowledge and methods in the field and fields where there is less consensus (Braxton & Hargens, 1996). Braxton and Hargens, in their review of different classifications of fields of study note that this dimension has been identified, using different terminology, by several scholars interested in identifying ways of modeling or typifying academic disciplines. Biglan's two other dimensions distinguish between fields that concentrate on creating knowledge (pure) or applying knowledge from other fields (applied) and those that focus on living organisms (life) or things that are not alive (non-life).

Research on disciplinary differences among faculty spans a range of issues (see Braxton & Hargens, 1996). Of particular interest to our investigation are those studies that examine differences in how faculty members teach. Neumann, Parry, and Becher (2002) and Braxton and Hargens (1996) each analyze studies on a variety of topics and identify their implications for how discipline influences teaching, paying particular attention to differences between hard and soft dimensions. Several studies suggest that faculty in soft disciplines are more likely than those in hard disciplines to emphasize deep approaches to learning. For example, faculty in soft disciplines are more likely to discuss alternative or critical perspectives in their courses (Gaff & Wilson, 1971; Lattuca & Stark, 1994). In addition, faculty from soft disciplines are also more likely to encourage analysis and synthesis while faculty from hard disciplines require more memorization and application of course concepts (Braxton & Nordvall, 1985; Smart & Ethington, 1995). While there is evidence of important distinctions among disciplines along Biglan's other dimensions, particularly pure-applied (Neumann et al., 2002), there is little evidence to suggest that Biglan's other dimensions play much of a role in determining how faculty teaching methods emphasize deep approaches to learning.

Purpose of the Study

The purpose of this study is to examine how the amount faculty members emphasize student engagement in deep approaches to learning varies by disciplinary area. To what extent do college and university faculty members encourage deep learning behaviors? Does the emphasis on deep learning approaches vary systematically by field of study? Is it emphasized more in "soft" fields and less in hard fields? Because many faculty members at least somewhat emphasize good educational practices (e.g., active and collaborative learning), it is likely that we will find that faculty members do emphasize deep learning. At the same time, deep learning emphasis will likely vary across major fields, as suggested by previous research, particularly work contrasting teaching approaches in "hard" and "soft" disciplinary areas. In comparing the results of this study to a similar study on students (Nelson Laird, Shoup, & Kuh, 2005), we intend to examine whether the patterns of variation among disciplinary areas is different among faculty than among students.

Methods

Data Source

The data for this study come from the 2005 administration of the Faculty Survey of Student Engagement (FSSE), an annual survey of faculty teaching undergraduates at four-year colleges and universities across the country designed to complement the National Survey of Student Engagement by asking faculty about the value and emphasis they place on activities that prior research has connected to valued outcomes (Chickering & Gamson, 1987; Kuh, 2001, 2003; Pascarella & Terenzini, 2005). Institutions that participate in NSSE can choose to participate in FSSE and select their own sample of faculty to survey. Given that the focus of the survey is on undergraduate teaching and learning, institutions are encouraged to submit contact information only for those faculty members who teach undergraduates. The vast majority of institutions survey all undergraduate teaching faculty.

Although not representative of all U.S. four-year colleges and universities, the 109 institutions represent a wide cross-section of U.S. four-year institutions of higher education. For example, of the 109 institutions, 23% are doctoral, about 50% are master's level, 9% are liberal arts, and 19% are baccalaureate general. In addition, public and private institutions are about equally represented among the participating colleges and universities.

In 2005, FSSE was a completely online survey and did not take faculty long to complete (most finished in around 15 minutes). In addition, faculty members were actively encouraged to participate by their institutions and faculty responses were anonymous. These are among the reasons faculty responded at relatively high rates. Because the survey was anonymous, calculating exact response rates is difficult. However, FSSE staff estimate that the average institutional participation rate was close to 50% for the institutions in this study.

Sample

The sample for this study, after deletion for missing data, consists of 9,294 faculty members. Faculty from seven disciplinary areas (Arts & Humanities, Business, Education, Engineering, Physical Science, and Social Science) were included in the study. For the most part, the seven areas map conveniently into Biglan's categories (1973a,b) (see Table 1). Faculty from professional (such as architecture, urban planning or nursing) and "other" (public administration, kinesiology, and criminal justice) fields were excluded from the analyses because these categories were eclectic in nature and did not map to Biglan's categories. Of the faculty members in the sample, 33% were in the arts and humanities, 8% were in a biological science, 11% were in business, 9% were in education, 5% were in engineering, 15% were in a physical science (including mathematics), and 19% were in a social science.

Out of the total number of respondents, approximately 41% were female and 84% were white (4% African American, 5% Asian, 3% Hispanic, 1% Native American, 2% other racial/ethnic background, and 1% multi-racial or ethnic), and about 87% were working full-time. In addition, about 22% were lecturers or instructors, 28% were assistant professors, 24% were associate professors, and 26% were full professors.

Measures

The faculty survey was designed to parallel NSSE's survey of undergraduate students. The faculty version focuses on faculty perceptions of how often their students engage in different activities, the importance faculty place on various areas of learning and development, the nature and frequency of faculty-student interactions, and how faculty members organize class time. The survey is available at the FSSE website, www.fsse.iub.edu. For many questions on the survey, including the deep learning items discussed below, faculty respondents were instructed to answer based on a particular course taught during the 2004-05 academic year.

In 2004 and 2005, a deep learning scale was developed for NSSE by combining items that tapped student participation in activities that cluster into three sub-categories of deep learning activities (Nelson Laird, Shoup, & Kuh, 2006):

- Higher-Order Learning - activities that require students to utilize higher levels of mental activity than those required for rote memorization;
- Integrative Learning - activities that require integrating acquired knowledge, skills, and competencies into a meaningful whole; and
- Reflective Learning - activities that ask a student to explore his/her experiences of learning to better understand how he/she learns.

Since the faculty survey parallels the student version, very similar items exist on both surveys. For faculty, however, the focus is on the importance and emphasis that they place on these activities in their courses. The scale, sub-scales, and component items from the faculty survey are given in Table 2. The internal consistencies are very similar to those on the student version (Nelson Laird, Shoup, & Kuh, 2006), indicating that the structure of the faculty items is likely similar to that of the student items.

In some of the analyses described below, mean differences between disciplinary areas are calculated controlling for several characteristics. The control variables include faculty characteristics such as gender, race, rank, and full-time/part-time status as well as institutional characteristics such as Carnegie type (all variables are listed in Appendix A).

Data Analyses

For our analyses, we divided faculty members into the 7 disciplinary areas listed in Table 1 based on the field in which their selected course was being taught. Mean scores for each disciplinary area were compared (biological science was selected as the comparison group, as was done in our disciplinary comparisons for students; Nelson Laird, Shoup, & Kuh, 2005). We report two standardized mean differences (i.e., effect sizes with pooled standard deviations): one without controls and one after controlling for the effects of the variables in Appendix A. Standardized mean differences were calculated using regression analyses where the dependent measures were first standardized.

The effect size without controls represents the raw difference in emphasis on areas of deep learning between a disciplinary area and the comparison group, biological science. That is, for a typical course captured in this study from education, for example, the effect size without controls represents the magnitude of the difference in the emphasis placed on deep learning compared with the typical biological science course. The effect size with controls represents how much of the difference is due to the fact that the course is an education course and not to other characteristics of the course (e.g., whether it is an upper or lower division course), or characteristics of the faculty member teaching it (e.g., gender, race, or rank).

Limitations

There are two primary limitations of this study. First, due to the nature of participation in FSSE, our sample of faculty comes from a convenience sample of institutions. This suggests that caution should be used when generalizing our findings to faculty at other institutions of higher education. Fortunately, the 109 institutions included in this study represent a wide cross-section of U.S. four-year colleges and universities where, in nearly all instances, all undergraduate teaching faculty or simply all faculty members were surveyed. In addition, participation in the survey was respectable (greater than 30%) at nearly all institutions. While it is certainly possible that the results of a similar study done on faculty from a particular segment of institutions (e.g., elite research universities) would produce quite different results, it would be surprising if other studies done on faculty from U.S. institutions in general did not find similar results.

Second, faculty members were given a choice about which course they would answer questions. While course characteristics (e.g., upper or lower division and size) indicated a wide cross-section of course types covered in the survey, there is the possibility that faculty members' choices were not entirely random. For example, there could be a bias toward selecting smaller lower division courses, when possible. This suggests that caution should also be used when generalizing beyond the courses covered by faculty responses.

Results

Tables 3 through 6 contain the results of the mean comparisons for the emphasis on deep learning scale and its subscales by disciplinary area. In each table, disciplinary groupings are listed in rank order according to their mean on the corresponding deep learning scale. The results suggest that the average faculty member emphasized deep approaches to learning with some regularity, as the means for all faculty range from 2.61 to 3.19 on scales that range from 1 to about 4.

Faculty emphasis on deep learning does vary across disciplines. The difference of the means for the lowest scoring group and the highest scoring group ranges from slightly more than half a standard deviation for emphasis on integrative learning to about one and a quarter standard deviations for emphasis on deep learning, emphasis on higher order learning, and the importance of reflective learning. While these are appreciable differences, there are not instances where the difference is an indication that the lowest scoring field is essentially void of such activities. In fact, many faculty members in every disciplinary area emphasize deep learning approaches to a relatively high degree.

For the emphasis on deep learning scale (Table 3), faculty members in education have the highest average score even after controlling for several characteristics (effect size with controls = 0.74, $p < 0.001$). Not far behind are faculty from the arts and humanities (effect size with controls = 0.71, $p < 0.001$) and faculty from social science fields (effect size with controls = 0.64, $p < 0.001$). The effect size calculations suggest that faculty in these disciplinary areas score considerably higher than faculty in biology (the reference group), a group that ranks fifth out of the seven disciplinary areas. Even after the introduction of controls, the field with the lowest average on this scale, physical science, is almost an entire standard deviation away from the average for education faculty.

Faculty averages in the physical sciences (effect size with controls = -0.21, $p < 0.001$) and engineering (effect size with controls = -0.11, $p < 0.001$) are significantly lower on the emphasis on deep learning scale than faculty in biology. These effect sizes are relatively small, suggesting that some of the differences between biology and these disciplinary areas may be due to differences in the characteristics of students who choose to major in these areas.

Figure 1 plots the effect sizes (after controls have been introduced) for the deep learning scale and each of its subscales. Only six disciplinary areas are shown because all of the effect sizes are relative to biological science. The pattern of effects is quite similar for the emphasis on deep learning scale, the emphasis on integrative learning scale, and the importance of reflective learning scale. Faculty in the social sciences, arts and humanities, and education score well above biology while faculty from business score slightly above and faculty from physical science and engineering score below.

However, the pattern of effects for emphasis on higher-order learning stands out as different. For this scale, faculty from all six disciplinary areas shown in Figure 1 score higher, on average, than faculty from biological science. While faculty from education, arts and humanities, and social science still score the highest (effect sizes with controls from .40 to .47, $p < .001$), the size of the effects is smaller than for the other scales. Interestingly, engineering faculty score higher on this scale than faculty from business and the effect sizes with controls are nearly identical for business and physical science faculty (.26 and .24, respectively; $p < .001$ for both).

With biological science as the reference group (the x-axis in Figure 1), if we assume that an effect size of .3 or greater represents a meaningful difference, we can look at the disciplinary areas "close" to the reference group, those that score above, and those that score below. This results in two or three clusters of disciplinary areas for each of the four scales. Across the four scales education, arts and humanities, and social science faculty cluster together with relatively high averages. For the overall scale and the emphasis on higher-order learning sub-scale, the remaining disciplinary areas—business, biological science, engineering, and physical science—cluster together. However, the "distance" between these clusters (distance being the difference in effect size between the lowest group in the higher cluster and the highest group in the lower cluster) is much larger for the emphasis on deep learning scale than the emphasis on high-order thinking sub-scale. This is another way of demonstrating that the averages by disciplinary area are more spread out for the overall scale than for the emphasis on higher-order thinking sub-scale.

For the emphasis on integrative learning and importance of reflective learning sub-scales, the lower cluster mentioned above (business, biological science, engineering, and physical science), separates into two. For, emphasis on integrative learning, business, biological science, and engineering cluster together while physical science faculty score meaningfully below biological science faculty. For importance of reflective learning, the grouping is only different in that engineering faculty now cluster with physical science faculty in the lowest scoring group.

Discussion and Implications

Although the results of this study suggest that there are substantive differences by disciplinary area in the emphasis faculty place on deep approaches to learning, it is important to recognize that the results do not imply that a focus on deep approaches to learning is alien to any disciplinary area in this study. On the contrary, the means suggest that there are faculty members in all of the areas that emphasize deep approaches to learning in their teaching. The implication of this, as we pointed out in our earlier work (Nelson Laird, Shoup, & Kuh, 2005), is that those concerned with changing practices within their field or in their own teaching do not necessarily have to look externally for assistance. It is likely that a colleague down the hall or somewhere in the same building can provide examples of how to increase one's emphasis on higher-order, integrative, or reflective learning.

In agreement with earlier studies on faculty teaching practices (e.g., Braxton & Nordvall, 1988; Gaff & Wilson, 1971; Smart & Ethington, 1995), we found that faculty members in soft disciplinary areas are more likely to emphasize deep approaches to learning than those in hard disciplinary areas. This split is cause for concern in that there is evidence to suggest that student uses of deep approaches to learning are positively related to student outcomes across all disciplinary areas (Nelson Laird, Shoup, & Kuh, 2005).

While the hard-soft split is clear in our results, business faculty seem to hover in between the two groups. Across the scales, the average scores for business faculty were more often closer to biology or the other hard disciplinary areas than they were to other soft disciplinary areas. Given that business draws on several disciplinary traditions, it may be necessary to explore differences by subgroups within business (e.g., business administration and marketing) in order to better understand business faculty responses on the emphasis on deep learning scales,. Although beyond the scope of this study, there are likely enough cases in this data set to find 4 or more sub-categories of business that could be meaningfully compared.

Beyond the distinctions between hard and soft disciplinary areas, no clear conclusions could be drawn based on Biglan's (1973a,b) other dimensions (pure-applied and life-non-life). While it is useful to have the hard-soft distinction as a lens through which one can examine our results, there is a need for more research on the differences in teaching behaviors that examines the explanatory power of alternative methods of categorizing disciplinary areas (e.g., Holland, 1997). While not all of Holland's types of environments are as clearly connected to deep learning as the paradigmatic nature of the hard-soft dimension, his typology of disciplinary environments has proved useful in understanding certain areas collegiate teaching (e.g., Smart, Feldman, & Ethington, 2000; Smart & Umbach, 2005).

While the hard-soft split is clear in the faculty results, the results from the student data (Nelson Laird, Shoup, & Kuh, 2005) are not as clearly divided. In general, seniors in social science and arts and humanities score high, with education, biological science, and business seniors scoring in the middle and engineering and physical science seniors scoring lowest (based on effect sizes after controlling for student characteristics). While this preserves some semblance of the hard-soft split that is apparent in the faculty data, the distinction is not as clear.

For example, as with the faculty results, the pattern among seniors is quite different for the higher-order learning sub-scale. For that scale, engineering and physical science seniors score near the top. In addition, across the scales, the soft-applied areas—education and business—generally have scores similar to biology and the other hard fields, not the soft-pure fields.

This comparison to the student results suggests several important questions in need further exploration. First, what explains the differences in the patterns from students to faculty? Does it relate to student course taking patterns? Is it explained by differences in students' and faculty members' conceptions of their fields? Or could it be an outcome of poor transmission of goals and expectations in certain fields? Perhaps the observed differences in student and faculty results is attributable to the fact that seniors in, for example, education may not take as many classes with education faculty during their senior year as seniors in other fields. Alternatively, some education seniors are rooted in education and a discipline. Perhaps this dual socialization leads to the observed differences. Or, perhaps education faculty intend to emphasize deep approaches to learning in the courses, but simply do not do so as effectively as faculty in other disciplinary areas. All of these explanations seem plausible and worth further exploration.

Second, it seems important for future research to examine more closely the results related to higher-order learning. What is causing the pattern of results for that scale to look different than the pattern for the other scales? It is possible, because the differences between the fields on this scale are smaller than for other scales, that the fluctuation in pattern is simply statistical "noise." It could also be that these items tap an aspect of deep learning that is valued differently by the disciplinary areas, which would not be entirely surprising given the different ways the disciplinary areas organize knowledge and their methods of inquiry (see Becher & Trowler, 2001; Neumann et al., 2002).

Conclusion

Are college and university faculty encouraging a “deep” type of learning in their courses? For many faculty members in this study, the answer to this question is yes. However, our results suggest that the level of encouragement varies considerably by disciplinary area with soft disciplines (education, arts and humanities, and social science) encouraging deep learning to a greater extent than hard disciplines (biological science, engineering, and physical science). This hard-soft split is not unexpected given the paradigmatic and pedagogical differences in the disciplinary areas. However, the connection between adopting deep approaches to learning and important educational outcomes makes this split more than just another notable difference in perspective and teaching style. Students in the hard disciplines benefit in the same way from deep approaches to learning that students in other disciplines do. Consequently, this split is something for colleges and universities to pay attention to and address.

It is encouraging that the mean scores for all disciplinary areas are high enough to suggest that folks don’t have to look far to find examples of effective ways to promote deep approaches to learning. This means that we don’t have to tell engineering faculty, for example, that they have to teach more like faculty in the arts and humanities. Rather, the message can be disciplinary based. Faculty in each field should be encouraged to identify best practices in their own areas, perhaps their own departments or schools. And while this message may be of particular importance for hard disciplinary areas, there is room for improvement in all areas. So, encouraging deep approaches to learning can be an institutional focus and a priority for each field.

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Appendix A
Control Variables

Name	Description
Gender	0 = Male; 1 = Female
Ethnicity[a]	African American, American Indian, Asian American, White[b], Hispanic, Other, Multiple ethnic identifications
Course Level	0 = Lower division, 1 = Upper division
Employment Status	0 = Part-time; 1 = Full-time
Rank[a]	Lecturer/instructor[b], Assistant professor, Associate professor, Full professor
Fraternity or Sorority Membership	0 = Non-member; 1 = Member of a social fraternity or sorority
Student Athlete	0 = Non-athlete; 1 = Student athlete on a team sponsored by the institution's athletic department
Carnegie Classification[a]	Doctoral - Extensive, Doctoral - Intensive, Master's Colleges and Universities I & II, Baccalaureate - Liberal Arts[b], Baccalaureate - General, Other classification
Institutional control	0 =Public; 1 = Private

[a] Coded dichotomously (0 = not in group, 1 = in group)

[b] Reference group

Table 1.
Disciplinary Areas by Biglan Categories

	Degree of Consensus	
	High Consensus (Hard)	Low Consensus (Soft)
Pure	Biological Science (Life) Physical Science (Non-Life)	Arts & Humanities (Non-Life) Social Science (Life)
Applied	Engineering (Non-Life)	Business (Non-Life) Education (Life)

Categorization based on Biglan (1973a,b) and Braxton & Hargens (1996)

Table 2.
Emphasis on Deep Learning Scale, Subscales, and Component Items

Emphasis on Deep Learning ($\alpha = .77$)

Combination of the 3 subscales listed below

Emphasis on Higher-Order Learning ($\alpha = .73$)

Analyzing the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components[a]
Synthesizing and organizing ideas, information, or experiences into new, more complex interpretations and relationships[a]
Making judgments about the value of information, arguments, or methods, such as examining how others gathered and interpreted data and assessing the soundness of their conclusions[a]
Applying theories or concepts to practical problems or in new situations[a]

Emphasis on Integrative Learning ($\alpha = .71$)

Work on a paper or project that requires integrating ideas or information from various sources[b]
Have class discussions or writing assignments that include diverse perspectives (different races, religions, genders, political beliefs, etc.)[c]
Put together ideas or concepts from different courses when completing assignments or during class discussions[b]
At least once, discuss ideas from your readings or classes with you outside of class[d]
Discuss ideas or readings from class with others outside of class (other students, family members, co-workers, etc.)[b]

Importance of Reflective Learning[b,] ($\alpha = .82$)

Examine the strengths and weaknesses of their views on a topic or issue[b]
Try to better understand someone else's views by imagining how an issue looks from that person's perspective[b]
Learn something that changes the way they understand an issue or concept[b]

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[a] Faculty were asked how much (1=Very little, 2=Some, 3=Quite a bit, 4=Very much) a selected course emphasized this.
[b] Faculty were asked how important (1=Not Important, 2=Somewhat Important, 3=Important, 4=Very Important) it was for students to do this in a selected course.
[c] Faculty were asked how often (1=Never, 2=Sometimes, 3=Often, 4=Very often) students in a selected course engage in this.
[d] Faculty were asked the percentage (1=None, 2=1-24%, 3=25-49%, 4=50-74%, 5=75-100%) of students in a selected course that did this.

Table 3.
Differences in Emphasis on Deep Learning by Disciplinary Area

	N	Mean	SD	Mean Difference From Biology	Effect Size w/o Controls	Effect Size with Controls
Education	842	3.25	0.54	0.53	0.89 ***	0.74 ***
Arts & Humanities	3,089	3.15	0.53	0.43	0.71 ***	0.71 ***
Social science	1,729	3.14	0.52	0.42	0.70 ***	0.64 ***
Business	1,043	2.90	0.57	0.18	0.30 ***	0.22 ***
Biological science	754	2.72	0.61			
Engineering	456	2.64	0.55	-0.08	-0.13 *	-0.11 *
Physical science	1,381	2.54	0.57	-0.18	-0.29 ***	-0.21 ***
Total	9,294	2.98	0.60			

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

Table 4.
Differences in Emphasis on Higher-Order Learning by Disciplinary Area

	N	Mean	SD	Mean Difference From Biology	Effect Size w/o Controls	Effect Size with Controls
Education	842	3.33	0.60	0.36	0.57 ***	0.47 ***
Social science	1,729	3.25	0.60	0.29	0.45 ***	0.40 ***
Arts & Humanities	3,089	3.24	0.64	0.27	0.43 ***	0.45 ***
Business	1,043	3.18	0.62	0.22	0.34 ***	0.26 ***
Engineering	456	3.18	0.58	0.21	0.33 ***	0.30 ***
Physical science	1,381	3.07	0.64	0.10	0.16 ***	0.24 ***
Biological science	754	2.96	0.69			
Total	9,294	3.19	0.64			

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

Table 5.
Differences in Emphasis on Integrative Learning by Disciplinary Area

	N	Mean	SD	Mean Difference From Biology	Effect Size w/o Controls	Effect Size with Controls
Education	842	2.99	0.64	0.58	0.83 ***	0.64 ***
Arts & Humanities	3,089	2.77	0.63	0.36	0.51 ***	0.51 ***
Social science	1,729	2.75	0.64	0.33	0.48 ***	0.40 ***
Business	1,043	2.58	0.65	0.17	0.24 ***	0.13 **
Biological science	754	2.42	0.66			
Engineering	456	2.31	0.62	-0.11	-0.16 **	-0.11 *
Physical science	1,381	2.10	0.65	-0.31	-0.45 ***	-0.36 ***
Total	9,294	2.61	0.70			

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

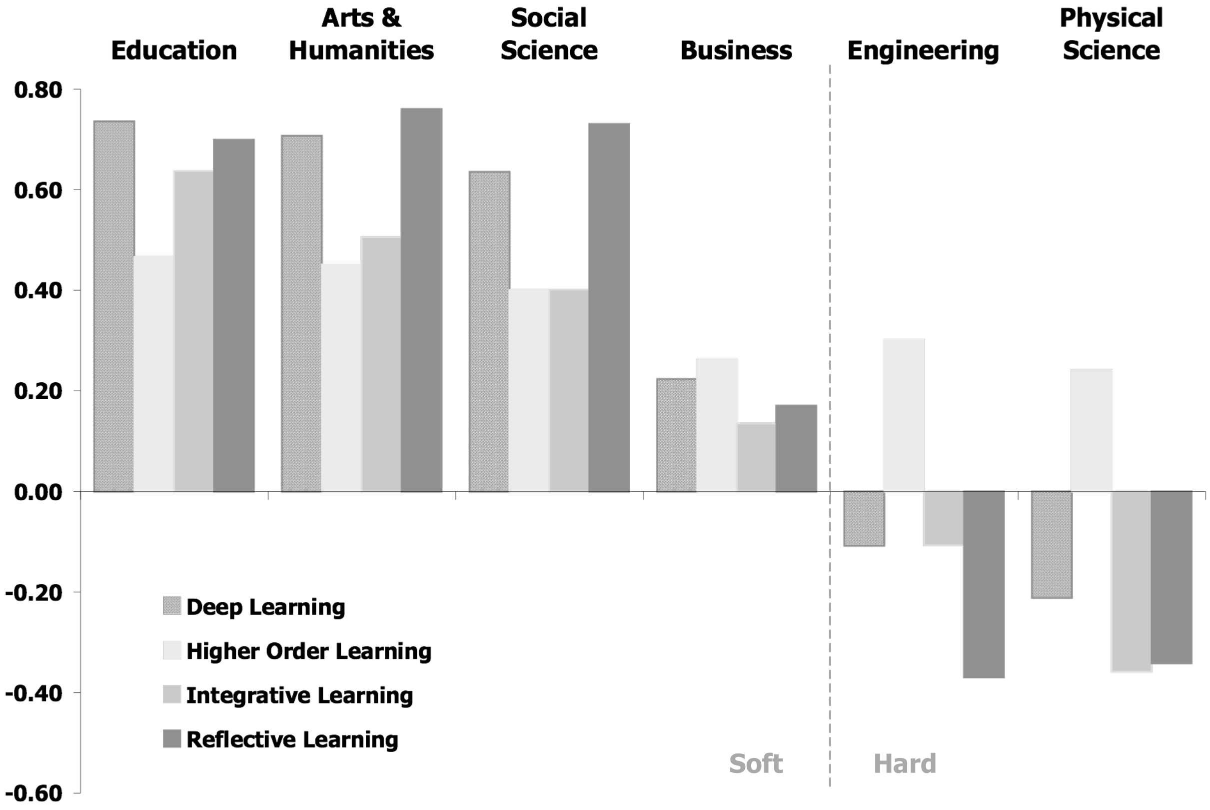
Table 6.
Differences in Importance Placed on Reflective Learning by Disciplinary Area

	N	Mean	SD	Mean Difference From Biology	Effect Size w/o Controls	Effect Size with Controls
Education	842	3.44	0.67	0.66	0.79 ***	0.70 ***
Arts & Humanities	3,089	3.43	0.69	0.66	0.78 ***	0.76 ***
Social science	1,729	3.42	0.67	0.65	0.77 ***	0.73 ***
Business	1,043	2.94	0.78	0.16	0.20 ***	0.17 ***
Biological science	754	2.78	0.87			
Physical science	1,381	2.46	0.83	-0.32	-0.38 ***	-0.34 ***
Engineering	456	2.44	0.83	-0.34	-0.40 ***	-0.37 ***
Total	9,294	3.13	0.84			

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

Figure Caption

Figure 1. Disciplinary Effect Sizes With Controls (Relative to Biological Science)


Education
Arts & Humanities
Social Science
Business
Engineering
Physical Science
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
Deep Learning
Higher Order Learning
Integrative Learning
Reflective Learning
Soft
Hard