A Quasi-Experimental Multilevel Study Examining High-Impact Practices and Deep Approaches to Learning

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Abstract:

High-impact practice research often focuses on improving student persistence and academic achievement with less of an emphasis on the development of student learning processes. Further, many studies historically center majority populations in research due to sample size restrictions or methodological procedures. This study uses national survey data to examine over 347,000 seniors' experiences at more than 1,100 four-year colleges and universities with high-impact practices and students' reported learning processes. A hierarchical linear model with propensity scores and effect codes show the relationship between six high-impact practices and students' learning processes while de-centering motivating factors and majority populations. Findings indicate both service-learning and learning communities promoted the outcomes under investigation with mixed results among the others. Differences emerged by race/ethnicity, gender identity, sexual orientation, and ability status. We broadly discuss implications for higher education and future research.

Keywords: *high-impact practices, underrepresented students, learning processes, survey research, multilevel modeling*

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High-impact practices are meaningful educational experiences that institutions provide students to help achieve desired learning gains and a host of outcomes (Kilgo et al., 2015; Kuh et al., 2017). Yet, research historically makes large claims about their impact and compares majority against marginalized students, casting a spotlight on dominant populations with a deficit focus on smaller groups (Kuh, 2013; Wolniak & Enberg, 2019). Further, past research overlooked the notion that many students self-select to partake in high-impact practices and that the practices are not equitably available for all students (Stewart & Nicolazzo, 2019). A reimagination of quantitative methods allows scholars to build on previous works and develop a wave of research to amplify marginalized voices as well as make better inferences about the effects of high-impact practices (see Johnson & Stage, 2018; Mayhew & Simonoff, 2015). The present study seeks to clarify the relationship between soon to be graduates who partake in high-impact practices and their deep approaches to learning.

Conceptual Framework

Biggs' (1999) 3P Model of Teaching and Learning posited that presage, or inputs, were related to students learning processes and subsequently a product. In this study, student demographics and variables related to their environment serve as the presage while the high-impact practices are the learning-focused processes. The product is the outcome, deep approaches to learning; these learning processes are important as they are often associated with increased cognitive and academic gains (e.g., critical thinking and GPA; Biggs et al., 2001; Nelson Laird et al., 2005). Deep approaches to learning are conceptualized as two elements. First, high-order learning is described as students who connected their prior knowledge to new

facets of information, and secondly, reflective and integrative learning processes are those where students relate learning to the world around them (BrckaLorenz & Nelson Laird, 2017; Nelson Laird et al., 2005).

Literature

We organize the literature based on the Bigg's 3P Model of Teaching and Learning conceptual framework. We start by discussing components of presage, outlining the inequities that exist within student participation in high-impact practices. Next, we highlight high-impact practices and the variation in student participation as well as outcomes; these practices act as processes that facilitate student learning. Finally, we interrogate deep approaches to student learning to show how these can be a product of high-impact practices and a broad goal of higher education.

High-Impact Practices & Student Participation

The phrase "high-impact practices" was coined in 2006 (NSSE, 2006). These experiences often encompass study abroad, internships, learning communities, research with faculty, capstone or senior projects, and service-learning courses (Finley & McNair, 2013). Kuh (2008) posited every student should complete two by the time they graduate as the activities increased learning, retention, and post-graduation employment rates (Kilgo et al., 2015; Kuh et al., 2017). While additional high-impact practices exist, the six outlined above are the focus of this study given the wealth of research on them and their contentious nature (Kilgo et al., 2019; Stewart & Nicolazzo, 2019).

High-impact practices provide students the chance to process what they learned in the classroom and apply it to different contexts (Kuh, 2008). Faculty, staff, and students often reported value in capstone course experiences due to their reflective nature, allowing students to

leverage advanced skills in application of knowledge, writing, and speaking (McGill, 2012). Yet, not all students receive the opportunity to participate. Differences in high-impact practice participation vary by student demographics.

The National Survey of Student Engagement (NSSE, 2019a) found stark differences in participation rates between students of color and White senior students, regarding internships. Within a sample of over 140,000 college seniors, White students completed the experience 10% more than almost all of their peers. Moreover, first-generation senior students completed internships 15% less than their counterparts; the data did not show participation rates of students with disabilities or students with marginalized sexual orientations (NSSE, 2019a). These findings seem alarming given Kuh (2008) summarized that students from underrepresented backgrounds tended to benefit more from high-impact practices than their peers yet underrepresented students completed high-impact practices at lower rates. Covington (2017) discussed Black students likely do not study abroad as frequently as peers due to financial complications.

Variation in Student Outcomes by High-Impact Practices

Student gains vary among high-impact practices (Finley & McNair, 2013; Garvey et al., 2018; Kuh, 2008). Miller and colleagues (2018) found students who participated in service learning were more likely to report being employed after graduation, and participation in an internship increased the chances that a student had planned to start a job after graduation. Bowman and Holmes (2018) discovered that undergraduate researched positively related to senior students' academic GPA. Similarly, students who completed an internship during college received higher grade point averages than their peers (Knouse & Harris, 1999). Astin and colleagues (2000) found a positive relationship between students who participated in service-learning based courses and their selection of service-related career fields. Researchers also

discovered differences by academic discipline where sciences and engineering students more likely pursued careers after graduation than their education and social sciences peers (Miller et al., 2018).

In another study, high-impact practices broadly improved Black students' retention between their first and second year as well as boosted GPAs for Hispanic students (Finley & McNair, 2013). Pascarella and Terenzini (2005) discovered racial minority students who participated in undergraduate research experiences reported higher aspirations to attend graduate school. Kilgo and colleagues (2019) reported that LGBQ+ undergraduate and graduate students who participated in research with faculty reported higher levels of academic development. While some studies exist on small populations, many centered majority populations, creating questions about the findings (e.g., are the effects for marginalized students under- or over-stated).

Deep Approaches to Student Learning

Students make meaning of their learning experiences through a variety of means (Bruning et al., 2011). Scholars believed two approaches to learning exist, surface-level and deep approaches; the former entails students looking to complete tasks that satisfy immediate goals while the latter requires students to reflect on multiple facets of learning and apply knowledge to a different arena (Beattie et al., 1997; Bruning et al., 2011; Tagg, 2003). Both approaches have merit, yet deep approaches to learning improves intellectual development, satisfaction with one's college experience, and academic grades (Biggs et al., 2001; Kuh, 2008; Nelson Laird et al., 2005; Zhang & Ziegler, 2016). To that end, scholars referred to two sub-components of deep approaches as reflective and integrative learning as well as higher-order learning (Nelson Laird et al., 2005).

Researchers defined higher-order learning as the processes in which a student takes prior

knowledge and related it to new information to accomplish a task or reach new conclusions (Lewis & Smith, 1993; Pike, 2006; Resnick, 1987). Meanwhile, scholars depicted reflective and integrative learning as the way students connect their learning more globally to the world around them (BrckaLorenz & Nelson Laird, 2017; Epstein, 2011). Student gains known to emerge from these processes include critical thinking, problem solving, verbal and written skills (Bruning et al., 2011).

High-impact practices appeared to promote deep learning as well as reflective and integrative learning (Finley & McNair, 2013; Kinzie, 2013; Kuh, 2008; Watson et al., 2016). Students who participated in service-learning courses reported the largest gains in deep learning among high-impact practices (Finley & McNair, 2013). However, little is known about other high-impact practices' connection to learning processes (Wawrzynski & Baldwin, 2014). It is not surprising higher-order learning and reflective and integrative learning are vital in promoting student growth as application of learning and individual reflection have shown to help individuals better understand an experience or knowledge (Fink, 2013; Jordi, 2010). Similarly, the crux of a high-impact practice is the matter of engaging students meaningfully at levels beyond the status quo to support deep learning (Kuh et al., 2017); thus, it is likely that partaking these experiences should report these outcomes. As such, this study seeks to answer questions about students' deep approaches to learning in relation to high-impact practices.

1. Who are the students that participate in two or more high-impact practices?
2. How does participation in high-impact practices relate to deep approaches to learning when controlling for institution type and comparing to like-peers?
3. What differences exist among students' deep approaches to learning when accounting for participation in high-impact practices?

Methods

Data

The data comprise of three years (2017-2019) of responses from the National Survey of Student Engagement (NSSE). NSSE is an annual survey where first-year and senior students from four-year colleges and universities answer items about the time and effort they put toward collegiate activities that research has shown to be related learning and development. Specifically, students respond about their interaction with faculty and peers, opportunities to interact with diverse others, and exposure to reflective and integrative course activities. Participation from over 1,100 four-year colleges and universities yielded a sample of 440,000 college seniors that was reduced to 347,000 after propensity score matching (see Table 1 & 2 for details). Two out of five (41%) students in this study attended doctoral-granting institutions with another two out of five (44%) enrolled at master's-granting institutions. Around two-thirds (63%) of students enrolled at publicly controlled institutions and nearly half (47%) of students enrolled at institutions with very large undergraduate populations. Overall, institutions that participate in NSSE mirror the overall diversity of bachelor's-granting institutions in the U.S. with regard to these and other institutional characteristics (NSSE, 2019b).

Measures

The aggregate measures used as dependent and independent variables in this study are known as some of NSSE's Engagement Indicators—constructs developed to serve as proxies representative of the multi-dimensional nature of student engagement. See Table 3 for descriptives and Appendix A for individual items.

Dependent Variables

The dependent variables in this study are representative of aspects of deep approaches to learning. The outcome variable reflective and integrative (RI) learning is a composite score comprised of seven items (alpha=.86). Questions included how often students combine ideas from different courses, connect their learning to societal problems, and include diverse perspectives. Higher-order learning is a second dependent variable comprised of four items (alpha =.83); items included: how much students' coursework emphasizes applying factors to new situations, analyzing lines of reasoning, and evaluating information sources.

Independent Variables

Six high-impact practices, educational aspirations, and first-generation status were coded dichotomously, respectively, based on participation, seeking a degree beyond a bachelors, and if any parent had attended college (Table 1 & 4). Among the student characteristics captured were race/ethnicity, gender identity, sexual orientation, ability status, and academic major; response options were not collapsed to better amplify marginalized students' voices. Additional controls included student-faculty interactions, quality of interactions with individuals on campus, supportive institutional environments, discussions with diverse others, and collaborative learning (Table 3; see Appendix A for individual items).

Analysis

Initial analysis demonstrated that the majority of students participate in at least one high-impact practice and greater differentiation exists in participating in two or more. For that reason, we compared students who participated in zero to one high-impact practice to those participating in two or more. We selected the cut off criteria of two high-impact practices given extant literature pertaining to notions that student should complete at least two and benefits increased with more participation (Huber, 2010; Kuh, 2008). This also informed our propensity score

matching (PSM) model, which was used to create a matched group of like-peers (Table 5; Song & Herman, 2010). A logistic model predicting participation in two or more high-impact practices was used to create a propensity score. The model was based on all student characteristics (race/ethnicity, gender, sexual orientation, disability status, parental education, and major) and known predictors of high-impact practice participation (educational aspirations, Student Faculty Interactions, Quality of Interactions, Supportive Environments, Discussions with Diverse Others, Collaborative Learning) to reduce the effect of self-selection bias; this is needed as students from privileged backgrounds often participated in high-impact practices more than their peers (Finley & McNair, 2013; Haeger et al., 2015). Nearest neighbor matching was used to create a matched dataset (match tolerance: propensity score < 0.00001). As seen in Table 5, students who completed two or more high-impact practices were significantly different from students who completed in zero-one high-impact practices in terms of student characteristics (ethnicity, sexual orientation, and disability status) and in major. The matched sample substantially reduces or eliminates those differences (Table 5).

Given the structure and size of the dataset, a hierarchical linear model was estimated with full maximum likelihood (Maas & Hox, 2005; Snijders & Bosker, 2012). Student level characteristics were input at level 1 with institutions at level 2; level 2 accounted for approximately 3% of the variance (Table 6). The student demographic variables were effect coded prior to being entered into the model to limit majority populations being reference categories (Mayhew & Simonoff, 2015).

Results

Students in this study represented a variety of diverse demographic backgrounds and student characteristics. The largest proportion of students in this study (16%) majored in health

professions or (16%) in business. Larger proportions of students also represented social sciences (12%), biological sciences (10%), and arts and humanities (10%) majors. Two-thirds of students (64%) aspired to graduate degrees. In terms of demographics, two-thirds of students (66%) identified as women, with a third (32%) identifying as men and smaller proportions preferring to not respond or identifying with another non-binary gender identity. Two-thirds (64%) of students identified as white with smaller proportions identifying as Hispanic or Latina/o (9%), multiracial (8%), Black or African American (7%), or Asian (7%). Close to one percent of students each identified as American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, or another racial/ethnic identification. Two in five (42%) students were first generation. Around one in ten students (10%) identified as bisexual, gay, lesbian, queer, or another minority sexual identity (LGBQ+) with a majority remainder (86%) identifying as straight. Over one in ten students (13%) reported having a disability or impairment with the largest portion of these students reporting a learning disability or a mental health disorder.

Question 1: Patterns of Participation

Descriptive statistics point to differences in who participates in 0-1 high-impact practices and those who complete 2 or more (Table 1). In looking at the percentage points, students who identify as students of color, men, another gender identity, straight, another sexual orientation, students with a mobility impairment, a disability not listed, or students with more than one disability are proportionality more represented for participating in 0-1 high-impact practices. This also is the case for students studying physical sciences, mathematics, computer sciences, social sciences, business, undecided and other majors. Meanwhile, students who are White, women, bisexual, queer, questioning, students with a mental health disorder, or no disability are more represented in completing 2 or more high-impact practices. This greater participation

pattern held for students majoring in biological sciences, agricultural, natural resources, communications, media, public relations, education, engineering, and health professions.

Question 2: Deep Approaches to Learning

There appear to be significant associations between high-impact practices and reflective and integrative learning (Table 7). Students who participated in study abroad (B = 0.03, $p < .001$), capstone (B = 0.03, $p < .001$), learning community (B = 0.03, $p < .001$), and a service-learning course (B = 0.08, $p < .001$) tended to use more reflective and integrative learning processes while controlling for a host of student characteristics. Meanwhile, students who participated in internships (B = -0.02, $p < .001$) used less reflective and integrative learning as well as students who participated in undergraduate research (B = -0.01, $p < .05$) though this difference is only marginally significant.

In considering the relationship between high-impact practices and higher-order learning we also found significant relationships (Table 8). Students who participated in capstone (B = 0.05, $p < .001$), learning community (B = 0.03, $p < .001$) or service course (B = 0.09, $p < .001$) experiences had higher levels of high-order learning while those who did study abroad (B = -0.04, $p < .001$) or internships (B = -0.04, $p < .001$) had lower levels. There was no significant relationship between undergraduate research and high-order learning.

Question 3: Differences in Deep Approaches to Learning

Net of high-impact practices, students differed by student background characteristics in reporting gains in reflective and integrative learning (Table 7) and higher-order learning (Table 8). All results should be interpreted in comparison to the average response as effect coding does not use a reference group.

Reflective & Integrative Learning.

Black or African American (B = 0.03, $p < .001$) and Multiracial (B = 0.02, $p < .001$) students reported higher use while Asian (B = -0.06, $p < .001$) and White (B = -0.04, $p < .001$) students reported less reflective and integrative learning. Women did more reflective and integrative learning (B = .03, $p < .001$). With respect to sexual orientation, straight students did less (B = -.14, $p < .001$) while bisexual (B = .03, $p < .001$) and queer students (B = .21, $p < .001$) did more. Students with a mental health disorder (B = .09, $p < .001$) or multiple disabilities or impairments (B = .06, $p < .001$) did more, while students without a reported disability or impairment (B = -.04, $p < .001$) did less. First-generation students (B = .04, $p < .001$) reported more as well as students who aspired to complete a graduate or professional degree (B = .10, $p <$ 001). We also found many differences in reflective and integrative learning by students' major field, refer to Table 7 for details.

Higher-Order Learning.

Asian (B = .02, $p < .01$), Hispanic or Latino (B = .03, $p < .001$) and Native Hawaiian or Other Pacific Islander (B = .07, $p < .05$) reported more high-order learning with less reported by White (B = -.07, $p < .001$), Other (B = -.04, $p < .05$), and Multiracial (B = -.03, $p < .001$) students. Women (B = .04, $p < .001$) engaged in more higher-learning activities. With respect to sexual orientation, queer students (B = .08, $p < .001$) engaged in more and straight students (B = -.03, $p < .001$) less. Students with a mental health disorder (B = .02, $p < .05$) reported more higher-order learning, whereas students without a disability or impairment (B = -.03, $p < .001$) did less. First-generation students (B = .06, $p < .001$) and students aspiring to pursue a graduate or professional degree (B = .06, $p < .001$) did more. We found many differences in higher-order learning by students' major field, refer to Table 8 for details.

Limitations

First, we would like to acknowledge we are unable to directly determine cause or directionality given the setup of our study even with the use of propensity score matching. The underlying data structure is correlational in nature, limiting some ability to generalize findings. Yet, we hope that the addition of propensity score matching can contribute to the body of literature linking high-impact practice participation and important social and academic outcomes. We accept that high-impact practices tend to be analogous to many other effective educational practices, yet institutions and scholars champion the prior greatly. However, in this study, we showcase evidence that high-impact practices can make a difference in students' learning.

With self-reported data, students could fabricate their results due to misinterpretation or social desirability (Porter 2011) although testing by NSSE staff have shown this to be unlikely (NSSE, n.d.). Institutions self-select into the survey instrument used to collect data thus potentially affecting representativeness of findings, institutions that participate in NSSE represent the diversity of four-year institutions in the United States (NSSE, 2019b); another possible, but unlikely complication is that students not progressing quickly through their studies could have completed the survey twice if their institution participated multiple years in a row.. Lastly, effect coding disrupts the norm of using majority students as reference categories, yet the average response is likely skewed due to the higher number of responses from the majority group. While we tried to disaggregate students into subpopulations when possible, we recognize that not all students within subgroups have monolithic experiences and the categorization of students inherently hides some variation.

Discussion

While numerically there may be more students of color participating in two or more high-impact practices, there is a higher proportion partaking in zero to one. This continues to reinforce postures about inequitable access to these educational practices (Finley & McNair, 2013; Stewart & Nicolazzo, 2019). This raises questions about where students of color are searching for enriching opportunities and what aspects of the college experience are not being captured by the original six high-impact practices. Further, controlling for student-faculty interactions may have deflated the effects of high-impact practices, as these interactions are known to have strong positive effects on marginalized students (BrckaLorenz et al., 2017; Davis, 2008).

The findings further affirm that there is a strong relationship between students partaking in high-impact practices and the use of deep approaches to learning processes. Largely results were positive, with participation in capstone courses, learning communities, and service-learning positively related to both reflective and integrative and higher-order learning processes. Although study abroad positively related to reflective and integrative learning, it had a negative relationship with higher-order learning. Similarly, internships and undergraduate research had negative or non-existent relationships with these approaches to learning. Given the proliferation of high-impact practices in the field of higher education these results should spark conversations (AAC&U, 2007; Finley & McNair, 2013). Sometimes high-impact practices happen outside of the university thus institutions may have less control of the experience (e.g., the fidelity of implementation may be jeopardized). It is also possible that by controlling for other aspects of engagement, such as student-faculty interaction, we inadvertently reduced the variation available to make connections between participation and learning given the importance of these aspects of engagement to making the experience “high-impact.”

Student populations use learning processes differently net of high-impact practices. It was important to interrogate deep approaches to learning without the often-positive bump from high-impact practices because of who often has access to participate. Findings demonstrated White students tended to partake less in learning processes compared to peers; it may be possible that White students are not be challenged during their academic experience to think complexly about ideas compared to their peers. Faculty and staff in charge of facilitating high-impact practices may try to further direct White students' learning processes.

Implications

While scholars frequently studied persistence and academic performance (usually GPAs) when looking at the effects of high-impact practices (Brownell and Swaner, 2009; Huber, 2010; Johnson & Stage, 2018; Kuh, 2013), focusing on high-impact practices and learning processes clarifies aspects of high-impact practices. Institutions seeking to achieve their institutional missions and outcomes pertaining to learning should consider high-impact practices as valuable mechanisms. Well-developed and structured high-impact practices continue to support development for many students yet not all students grow similarly from the experiences. Individuals who oversee high-impact practices should intentionally design them to target differing populations' learning needs.

In considering the added benefits from participating in high-impact practices for many students, it is important to reflect on what barriers institutions can remove to boost student participation or improve student experiences? Institutions committed to promoting reflective and integrative as well as higher-order learning for all students could work to develop resources (financial, personnel, etc.) to boost completion of high-impact practices. This is particularly important as research demonstrates students from marginalized backgrounds often gained more

from the experiences compared to their majority peers (Kuh, 2008). Moreover, devoting faculty and staff time or expenses to facilitate high-impact practices could cast a wider net, increasing students' participation.

Although high-impact practices lead to numerous benefits, they do not solve all problems (Kuh, 2010; Mayhew et al., 2016). Institutional leaders should continue to innovate campuses by introducing educational strategies that will produce critically important learning outcomes and serve a variety of populations. There may be strategies outside the canon of high-impact practices that exist that provide students equally powerful learning experiences. To that end, it is important to consider what practices can be scaled-up and what practices align best with an institution's culture. A research-extensive university may have the resources to provide many students deep undergraduate research opportunities while a baccalaureate college leverages its size to focus efforts on rigorous learning communities.

Conclusion

Future research may want to explore key learning indicators in relation to high-impact practices. Some aspects often include faculty who set high performance standards for students, provide frequent and timely feedback to students, and allow students opportunities to demonstrate their learning through varying assignments (Kuh et al., 2017). Lastly, expanding the variety of high-impact practices studied may be beneficial as peer mentoring, undergraduate conferences, and campus employment have been named influential due to their time intensive nature (Koolage & Clevenger, 2018; Kuh et al., 2017; McClellan et al., 2018). Looking at indicators of quality within high-impact practices and additional educational experiences in tandem will shape our understanding of the effectiveness of these practices as well as who benefits.

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Table 1. Student Characteristics by HIP participation

		0-1 HIPs		Two+ HIPs	
		Count	Percent	Count	Percent
Race/Ethnicity	American Indian or Alaska Native	359	0.5%	798	0.4%
	Asian	5015	7.5%	12145	6.5%
	Black or African American	5463	8.2%	13305	7.1%
	Hispanic or Latino	7257	10.8%	15969	8.5%
	Native Hawaiian or Other Pacific Islander	248	0.4%	531	0.3%
	White	39768	59.3%	121702	65.0%
	Another race/ethnicity	1101	1.6%	2682	1.4%
	Multiracial	5243	7.8%	14180	7.6%
	I prefer not to respond	2563	3.8%	6017	3.2%
Gender Identity	Man	23929	35.7%	83937	31.1%
	Woman	41553	62.0%	180292	66.9%
	Another gender identity	652	1.0%	2333	0.9%
	I prefer not to respond	883	1.3%	2927	1.1%
Sexual Orientation	Straight (heterosexual)	57643	86.2%	230698	85.8%
	Bisexual	2718	4.1%	13022	4.8%
	Gay	1063	1.6%	4372	1.6%
	Lesbian	700	1.0%	2712	1.0%
	Queer	488	0.7%	2634	1.0%
	Questioning or unsure	511	0.8%	2508	0.9%
	Another sexual orientation, please specify	890	1.3%	3233	1.2%
	I prefer not to respond	2825	4.2%	9791	3.6%
Ability Status	A sensory impairment	528	0.8%	2031	0.8%
	A mobility impairment	376	0.6%	1181	0.4%
	A learning disability	2244	3.4%	9228	3.4%
	A mental health disorder	2216	3.3%	10287	3.8%
	A disability or impairment not listed above	1028	1.5%	3654	1.4%
	More than one disability or impairment	1975	3.0%	7751	2.9%
	No disability or impairment	56002	83.9%	226407	84.2%
	I prefer not to respond	2399	3.6%	8218	3.1%
Major	Arts & Humanities	6184	9.3%	25271	9.3%
	Biological Sciences, Agriculture, & Natural Resources	6083	9.1%	27371	10.1%
	Physical Sciences, Mathematics, & Computer Science	3759	5.7%	13663	5.1%
	Social Sciences	8440	12.7%	33345	12.3%
	Business	12164	18.3%	40874	15.1%
	Communications, Media, & Public Relations	2441	3.7%	12553	4.6%
	Education	3851	5.8%	23057	8.5%
	Engineering	4969	7.5%	20965	7.8%
	Health Professions	10336	15.5%	42875	15.9%
	Social Service Professions	3548	5.3%	14261	5.3%

	All Other	4596	6.9%	15711	5.8%
	Undecided, undeclared	146	0.2%	397	0.1%
First Generation Status	Not first-generation	34482	51.5%	159527	59.3%
	First-generation	32535	48.5%	109340	40.7%
Educational Aspiration	Bachelors or less	27200	40.6%	98390	35.1%
	Graduate or professional degree	39817	59.4%	182176	64.9%

Table 2. Students by Institution Type

		Count	Percent
Carnegie Classification	Doctoral/Highest research	44647	17.0%
	Doctoral/Higher research	36535	13.9%
	Doctoral/Moderate	27450	10.4%
	Master's-Large programs	80608	30.6%
	Master's-Medium programs	24207	9.2%
	Master's-Small programs	11750	4.5%
	Baccalaureate-Arts & Sciences	19404	7.4%
	Baccalaureate-Diverse fields	14170	5.4%
	Other Carnegie Categories	4413	1.7%
Barrons Selectivity	Noncompetitive	4590	1.4%
	Less competitive	34079	10.6%
	Competitive and competitive plus	165841	51.7%
	Very competitive and very competitive plus	76151	23.7%
	Highly competitive and highly competitive plus	22171	6.9%
	Most competitive	18088	5.6%
Control	Public	218528	62.9%
	Private-not-for-Profit	122238	35.2%
	Private-for-Profit	6817	2.0%
Enrollment	Very Small (fewer than 1,000)	11457	3.3%
	Small (1,000-2,500)	50313	14.5%
	Medium (2,500-4,999)	52256	15.1%
	Large (5,000-9,999)	70461	20.4%
	Very Large (10,000 or more)	161594	46.7%

Table 3. Descriptive Statistics

		N	Min.	Max.	Mean	SE	SD	Var.	Skew.	Kurt.	Alpha
Dependent Variables	RI Reflective and Integrative Learning	346826	0	60	39.57	0.020	11.92	142.06	-0.09	-0.56	0.86
	HO Higher-Order Learning	344026	0	60	41.13	0.022	13.07	170.90	-0.31	-0.38	0.83
Independent Variables	SF Student-Faculty Interaction	344253	0	60	27.37	0.027	15.66	245.25	0.38	-0.58	0.83
	QI Quality of Interactions	337698	0	60	42.76	0.020	11.55	133.40	-0.61	0.20	0.81
	SE Supportive Environment	340355	0	60	33.70	0.023	13.56	183.91	0.03	-0.51	0.87
	DD Discussions with Diverse Others	345027	0	60	41.40	0.025	14.88	221.45	-0.41	-0.56	0.86
	CL Collaborative Learning	345263	0	60	35.29	0.024	14.10	198.75	-0.06	-0.57	0.80

See Appendix A for associated items

Table 4. High-impact Practices by HIP participation

		0-1 HIPs		Two+ HIPs	
		Count	Percent	Count	Percent
Study Abroad	Not done	65535	98.1%	213197	76.2%
	Done or in progress	1289	1.9%	66554	23.8%
Capstone	Not done	59755	89.5%	87780	31.4%
	Done or in progress	6994	10.5%	191845	68.6%
Internship	Not done	58894	88.1%	71618	25.6%
	Done or in progress	7938	11.9%	208439	74.4%
Learning Community	Not done	65064	97.5%	176074	63.0%
	Done or in progress	1645	2.5%	103326	37.0%
Undergraduate Research	Not done	65027	97.3%	176635	63.1%
	Done or in progress	1786	2.7%	103084	36.9%
Service Course	Not done	39262	59.0%	64756	23.2%
	Done or in progress	27257	41.0%	214817	76.8%

Table 5. Propensity before and after

		Before Match				After Match			
		N	Mean	SD	Sig.	N	Mean	SD	Sig.
American Indian or Alaska Native	1-2 HIPs	152624	0.01	0.08	***	67017	0.01	0.07	**
	2+ HIPs	268263	0.00	0.07	***	268263	0.00	0.07	**
Straight (heterosexual)	1-2 HIPs	163738	0.80	0.40	***	67017	0.01	0.10	*
	2+ HIPs	280566	0.82	0.38	***	269489	0.01	0.09	*
Queer	1-2 HIPs	163738	0.01	0.07	***	67017	0.02	0.12	
	2+ HIPs	280566	0.01	0.10	***	280566	0.02	0.12	
Questioning or unsure	1-2 HIPs	163738	0.01	0.08	***	67017	0.01	0.10	
	2+ HIPs	280566	0.01	0.09	***	280566	0.01	0.10	
A sensory impairment	1-2 HIPs	163738	0.01	0.09	***	67017	0.01	0.09	
	2+ HIPs	280566	0.01	0.08	***	280566	0.01	0.08	
A learning disability	1-2 HIPs	163738	0.03	0.17	***	67017	0.03	0.18	
	2+ HIPs	280566	0.03	0.18	***	280566	0.03	0.18	
More than one disability or impairment	1-2 HIPs	163738	0.03	0.17	***	67017	0.03	0.17	*
	2+ HIPs	280566	0.03	0.16	***	280566	0.03	0.16	*
Arts & Humanities	1-2 HIPs	163738	0.08	0.26	***	67017	0.09	0.29	
	2+ HIPs	280566	0.09	0.29	***	280566	0.09	0.29	
Health Professions	1-2 HIPs	163738	0.15	0.36	***	67017	0.15	0.36	
	2+ HIPs	280566	0.15	0.36	***	280566	0.15	0.36	
Propensity Score	1-2 HIPs	91192	0.55	0.19	***	67017	0.62	0.16	***
	2+ HIPs	175170	0.71	0.16	***	175170	0.71	0.16	***

*p<.05, **<.01, ***<.001 T-tests were used to compare demographics before and after matching. The treatment group was students who participated in two or more while the control group are those who did one or none.

Additional variables matched: Asian, Black or African American, Hispanic or Latino, White, Other, Multiracial, Race prefer not to respond, Man, Woman, Another Gender identity, Gender PNR, Bisexual, Gay, Lesbian, Another S/O, S/O PNR, Mobility Impairment, Mental Health Disorder, Disability not listed, Disability PNR, Biological Sciences, Physical Sciences, Social Sciences, Business, Communications & PR, Education, Engineering, Social Service Professions, All other majors, Undeclared, First-generation, Educational Aspiration, Student Faculty Interactions, Quality of Interactions, Supportive Environments, Discussions with Diverse Others, Collaborative Learning.

Table 6. Empty Model Variance

Fixed effects	Coefficient	SE
γ00 Intercept	39.83	0.07
Random effects	Var. comp	SD
τ^2	3.80	1.95
σ^2	138.82	11.78

Table 7. Multilevel Model Results for Reflective & Integrative Learning

	B	SE	Sig.
(Intercept)	-1.85	0.01	***
Study Abroad	0.03	0.00	***
Capstone	0.04	0.00	***
Internship	-0.02	0.00	***
Learning Community	0.03	0.00	***
Undergraduate Research	-0.01	0.00	*
Service-Learning Course	0.08	0.00	***
American Indian or Alaska Native	0.01	0.02	
Asian	-0.06	0.01	***
Black or African American	0.03	0.01	***
Hispanic or Latino	-0.01	0.01	
Native Hawaiian or Other Pacific Islander	0.02	0.03	
White	-0.04	0.01	***
Another race/ethnicity	0.02	0.01	
Multiracial	0.02	0.01	**
I prefer not to respond	0.01	0.01	
Man	-0.01	0.01	
Woman	0.03	0.01	***
Another gender identity	-0.02	0.01	
I prefer not to respond	0.00	0.01	
Straight (heterosexual)	-0.14	0.01	***
Bisexual	0.03	0.01	***
Gay	-0.01	0.01	
Lesbian	0.00	0.01	
Queer	0.21	0.02	***
Questioning or unsure	-0.01	0.02	
Another sexual orientation	0.00	0.01	
I prefer not to respond	-0.08	0.01	***
A sensory impairment	-0.01	0.02	
A mobility impairment	0.00	0.02	
A learning disability	-0.01	0.01	
A mental health disorder	0.09	0.01	***
A disability or impairment not listed above	-0.06	0.01	***
More than one disability or impairment	0.06	0.01	***
No disability or impairment	-0.04	0.01	***
I prefer not to respond	-0.01	0.01	
Arts & Humanities	0.19	0.01	***
Biological Sciences, Agriculture, & Natural Resources	-0.18	0.01	***
Physical Sciences, Mathematics, & Computer Science	-0.36	0.01	***
Social Sciences	0.29	0.01	***
Business	-0.05	0.01	***
Communications, Media, & Public Relations	0.17	0.01	***
Education	0.05	0.01	***
Engineering	-0.44	0.01	***
Health Professions	-0.02	0.01	***
Social Service Professions	0.26	0.01	***
All Other Majors	0.06	0.01	***

Undecided, undeclared	0.04	0.04	
First-generation	0.04	0.00	***
Graduate or professional degree	0.10	0.00	***

*<.05, **<.01, ***<.001; Demographic variables effect coded making coefficients available for all groups; Outcome variable standardized thus coefficients are interpreted as effect sizes; additional controls include student faculty-interactions, quality of interactions, supportive environments, discussions with diverse others, and collaborative learning indicators

Table 8. Multilevel Model Results for Higher-Order Learning

	B	SE	Sig.
(Intercept)	-1.78	0.01	***
Study Abroad	-0.04	0.01	***
Capstone	0.05	0.00	***
Internship	-0.04	0.00	***
Learning Community	0.03	0.00	***
Undergraduate Research	0.00	0.00	
Service-Learning Course	0.09	0.00	***
American Indian or Alaska Native	0.01	0.02	
Asian	0.02	0.01	**
Black or African American	0.01	0.01	
Hispanic or Latino	0.03	0.01	***
Native Hawaiian or Other Pacific Islander	0.07	0.03	*
White	-0.07	0.01	***
Another race/ethnicity	-0.04	0.01	*
Multiracial	-0.03	0.01	***
I prefer not to respond	-0.02	0.01	
Man	0.00	0.01	
Woman	0.04	0.01	***
Another gender identity	-0.03	0.02	
I prefer not to respond	-0.01	0.01	
Straight (heterosexual)	-0.03	0.01	***
Bisexual	-0.01	0.01	
Gay	0.01	0.01	
Lesbian	-0.02	0.02	
Queer	0.08	0.02	***
Questioning or unsure	-0.02	0.02	
Another sexual orientation	-0.01	0.01	
I prefer not to respond	-0.01	0.01	
A sensory impairment	0.02	0.02	
A mobility impairment	0.03	0.02	
A learning disability	-0.01	0.01	
A mental health disorder	0.02	0.01	*
A disability or impairment not listed above	-0.01	0.01	
More than one disability or impairment	0.00	0.01	
No disability or impairment	-0.03	0.01	***
I prefer not to respond	-0.02	0.01	*
Arts & Humanities	0.09	0.01	***
Biological Sciences, Agriculture, & Natural Resources	-0.06	0.01	***
Physical Sciences, Mathematics, & Computer Science	-0.06	0.01	***
Social Sciences	0.15	0.01	***
Business	-0.04	0.01	***
Communications, Media, & Public Relations	0.00	0.01	
Education	0.00	0.01	
Engineering	-0.04	0.01	***
Health Professions	0.07	0.01	***
Social Service Professions	0.10	0.01	***
All Other	-0.02	0.01	*
Undecided, undeclared	-0.17	0.04	***

First-generation	0.06	0.00	***
Graduate or professional degree	0.06	0.00	***

*<.05, **<.01, ***<.001; Demographic variables effect coded making coefficients available for all groups; Outcome variable standardized thus coefficients are interpreted as effect sizes; additional controls include student faculty-interactions, quality of interactions, supportive environments, discussions with diverse others, and collaborative learning indicators

Appendix

A. Survey Items

RI - Reflective & Integrative Learning

During the current school year, about how often have you done the following?

Response options: Very often, Often, Sometimes, Never

- Combined ideas from different courses when completing assignments
- Connected your learning to societal problems or issues
- Included diverse perspectives (political, religious, racial/ethnic, gender, etc.) in course discussions or assignments
- Examined the strengths and weaknesses of your own views on a topic or issue
- Tried to better understand someone else's views by imagining how an issue looks from their perspective
- Learned something that changed the way you understand an issue or concept
- Connected ideas from your courses to your prior experiences and knowledge

HO - Higher Order Learning

During the current school year, how much has your coursework emphasized the following?

Response options: Very much, Quite a bit, Some, Very little

- Applying facts, theories, or methods to practical problems or new situations
- Analyzing an idea, experience, or line of reasoning in depth by examining its parts
- Evaluating a point of view, decision, or information source
- Forming a new idea or understanding from various pieces of information

SF - Student Faculty Interactions

During the current school year, about how often have you done the following?

Response options: Very often, Often, Sometimes, Never

- Talked about career plans with a faculty member
- Worked with a faculty member on activities other than coursework (committees, student groups, etc.)
- Discussed course topics, ideas, or concepts with a faculty member outside of class
- Discussed your academic performance with a faculty member

QI - Quality of Interactions

Indicate the quality of your interactions with the following people at your institution.

Response options: 1=Poor to 7=Excellent, Not Applicable

- Students
- Academic advisors
- Faculty
- Student services staff (career services, student activities, housing, etc.)
- Other administrative staff and offices (registrar, financial aid, etc.)

SE - Supportive Environments

How much does your institution emphasize the following?

Response options: Very much, Quite a bit, Some, Very little

- Providing support to help students succeed academically
- Using learning support services (tutoring services, writing center, etc.)
- Encouraging contact among students from different backgrounds (social, racial/ethnic, religious, etc.)
- Providing opportunities to be involved socially
- Providing support for your overall well-being (recreation, health care, counseling, etc.)
- Helping you manage your non-academic responsibilities (work, family, etc.)
- Attending campus activities and events (performing arts, athletic events, etc.)
- Attending events that address important social, economic, or political issues

DD - Discussions with Diverse Others

During the current school year, about how often have you had discussions with people from the following groups?

Response options: Very often, Often, Sometimes, Never

- People of a race or ethnicity other than your own
- People from an economic background other than your own
- People with religious beliefs other than your own
- People with political views other than your own

CL - Collaborative Learning

During the current school year, about how often have you done the following?

Response options: Very often, Often, Sometimes, Never

- Asked another student to help you understand course material
- Explained course material to one or more students
- Prepared for exams by discussing or working through course material with other students
- Worked with other students on course projects or assignments