

Bigger Can Be Better: Using the National Survey of Student Engagement (NSSE) to Examine the Relationship Between Good Practice and Undergraduate Outcomes at a Large Research University

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Abstract

This study examines students' reports of their satisfaction and their institution's contribution to their learning based on responses to the National Survey of Student Engagement (NSSE) from 1,536 first-year and senior students at a large, research-extensive university in the spring of 2004. The results suggest that high expectations and prompt feedback on academic performance are most strongly related to students' self-reports of their institution's contribution to analytic thinking and that prompt feedback on academic performance is most strongly related to student satisfaction—also a proxy for persistence—after controlling for entering student aptitude and other background characteristics. The consideration of multiple best practices simultaneously may improve our understanding of the most critical combination of practices and the unique contributions of each to learning, student satisfaction, and the likelihood of persistence. The implications for research and practice are discussed.

Student engagement is an established concept in the research literature and the national conversation regarding higher education quality and the impact of college attendance on students (Ku & Hu, 2001a; Kuh, 2001; National Survey of Student Engagement, 2001; Pike, 2004; Pike, Kuh, & Gonyea, 1993). It is most evident in the creation and growth of the National Survey of Student Engagement (NSSE) as a means to gauge “process indicators” of academic quality that are rooted in best practices and experiences that are related to student learning and development (Astin, 1993; Kuh, 2003; Pace, 1984; Pascarella & Terenzini, 1991a, 1991b). Given the persistent and growing dissatisfaction among various publics and the government with the limitations of and lack of actionable information gained from purely “resource and

reputation” models, paying greater attention to practices that enhance student learning represents a welcome development in the effort to determine how to measure and improve experiences and outcomes for undergraduate students. In fact, recent issues of the well-known college ranking guide “America’s Best Colleges” by *U.S. News and World Report* (USNWR) have included voluntary institutional reports of specific NSSE item results from a relatively small number of colleges and universities (USNWR’s “America’s Best Colleges,” 2002–2005). These results include student reports of the extent to which they asked questions in class, received prompt feedback on coursework, had discussions with instructors outside of class, wrote papers, and participated in research. In addition, the release of *A Test of Leadership: Charting the Future of U.S. Higher Education* (also known as the Spellings report) in 2006 by the Secretary of Education’s Commission on the Future of Higher Education—with its call for greater information transparency and accountability for student learning outcomes, college costs, and access to postsecondary education—reflects the need to identify the linkages between student background characteristics, behaviors, and experiences; institutional policies and practices; and the effects both have on various dimensions of student success, such as intellectual growth, skill acquisition, vocational outcomes, and personal development. At research-intensive universities—where missions are multifaceted, operations are large, and institutional organization is quite complex—facilitating student engagement may be particularly challenging to establish and improve. For example, among prior findings regarding educational practices and outcomes at research-intensive universities, Kuh, Pace, and Vesper (1997) reported that research and doctoral universities had the lowest mean scores in estimates of learning gains among undergraduate students as well as somewhat lower levels of faculty–student interaction.

Given these issues, a stronger focus on student learning outcomes and student persistence to degree represents institutional priorities for a number of interest groups: colleges and universities, faculty members, students, their families, and state and federal governments. Student learning and persistence to degree also represent key outcomes within cost, value-added, and return-on-investment perspectives on institutional performance. Additional analysis may help identify student experiences and practices that enhance the likelihood of degree

completion (increased efficiency where resources would otherwise be allocated) that should receive more targeted financial support, especially in an increasingly limited-resource environment.

Higher education researchers and scholars also have focused a great deal of attention on conceptual frameworks that explore various dimensions of practices, attitudes, and characteristics of students and institutions. Most notably, the concepts of student involvement (Astin, 1993), faculty–student interaction (Pascarella & Terenzini, 1991a, 1991b), and student academic and social integration (Spady, 1971; Tinto, 1975, 1993) represent explanatory approaches and focal points for studying the impact of college on students and as predictors of student persistence and development. Combined with a student engagement perspective, these concepts—the kinds of activities and behaviors in which students engage, and that institutions promote or inhibit—are summarized in Chickering and Gamson's (1987) well-known “Seven Principles for Effective Practice in Undergraduate Education.” These principles are:

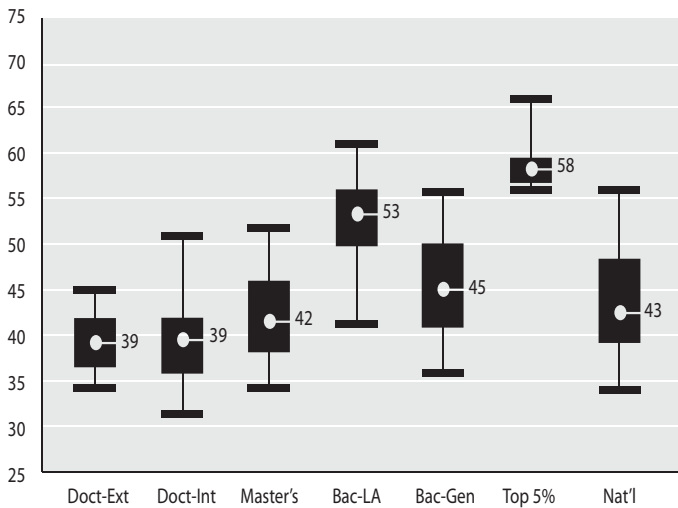
1. Student–faculty contact
2. Cooperation among students
3. Active learning
4. Prompt feedback
5. Time on task
6. Communication of high expectations
7. Respect for diverse talents and ways of learning

Although these principles are well known within the student affairs community, research has been limited in a few important respects. First, the extant literature reflects the “ecological fallacy” by assuming or suggesting that similar patterns and levels of engagement have the same effect across different students at different kinds of institutions. In other words, overall findings may not be applicable to particular institutions or types of institutions. This point is particularly interesting in the case of large, research-extensive universities that represent only about 3% of all Carnegie-classified institutions, yet grant approximately one third of all undergraduate degrees (Boyer Commission, 1998). Despite this fact, commensurate attention has not been given to analyses that

focus on undergraduate students attending larger institutions, where targeted changes based on such analyses could have a large impact.

Second, results from the National Survey of Student Engagement (NSSE) suggest considerable variation in the use of best practices within Carnegie institutional classifications. However, different classifications of institutions also vary in the kind (Pike & Kuh, 2005) and level (Pike, Kuh, & Gonyea, 2003; Umbach & Wawrzynski, 2005) of engagement in best practices (see Figure 1). Also, research-intensive institutions have been the focus of rather sharp critiques in recent years based on perceptions of a lack of attention and commitment to the quality of undergraduate programs (Boyer Commission, 1998). Given time and other resource limitations, analyses that move beyond norm-based or group comparisons to test empirical relationships based on established frameworks of quality in undergraduate education may provide a more effective means to focus ongoing improvement efforts.

FIGURE 1 | Student-Faculty Interaction Senior Benchmark Scores by Carnegie Classification



* SOURCE: Student Pathways to Collegiate Success, NSSE 2004 Annual Survey Results (http://www.iub.edu/~nsse/2004_annual_report/pdf/annual_report.pdf)

Third, whether or not there is a “synergy of best practices” supporting the improvement of student learning and student persistence represents an important topic for researchers and institutional leaders. Simply put, there is a need to examine whether priorities for student learning and student persistence are supported by similar or distinct components of Chickering and Gamson's best practice framework. Exploring this possibility may yield important results for those charged with enhancing undergraduate education within research-extensive institutions and lead to more effective interventions and policies.

Fourth, as the following literature review suggests, there appears to be a strong tendency to focus on a single best practice or on a limited set of the best practice principles within a given study. Although this is understandable given the challenges associated with data availability, NSSE makes it possible to examine many if not all of the seven best practice principles simultaneously. This step might help advance analyses of the relationships between best practices and student outcomes and better estimate the most critical combination of practices and the unique contribution of each to learning and persistence.

Research on the Seven Principles of Good Practice

The origin of the “seven principles” is well documented by Chickering and Gamson (1987, 1999) and Ewell and Jones (1996). As Chickering and Gamson explain, the idea to identify and articulate these principles emerged from reports in the early 1980s concerning higher education (Boyer, 1988) and from the desire to ensure that key ideas and results that emerged from work being done within the American Association of Higher Education (AAHE) made their way to the faculty, administrators, and students—those who could benefit from and most effectively convert the principles into concrete actions and innovation in undergraduate education. Empirical studies based on the “seven principles” have examined particular practices outlined within the framework. Most of these have focused on a particular practice or on a subset of the complete list of best practice categories. Overall, the following results obtained from prior studies support the relationship between these best practice

categories and various student outcomes. In short, what institutions and students do as part of the college experience matters more than “who they are” or “where they came from” in determining student learning and development during college (Kuh, 2001).

A number of studies support the conclusion that significant relationships exist between different components of the best practice framework and student outcomes. For example, Braxton, Olsen, and Simmons (1998) found that students preferred four of the seven best practices within “soft paradigmatic” disciplines: student–faculty interaction, active learning, high expectations, and respect for diverse talents and ways of knowing. Kuh, Pace, and Vesper (1998) concluded that active learning experiences and cooperation among students had the strongest relationship with learning gains (general education and intellectual skills) and that student background characteristics had a minimal effect. However, the authors also pointed out the need for a more comprehensive set of indicators of best practices in undergraduate education. Kuh and Vesper (1997) also found that faculty–student interaction—in addition to the extent of student–peer cooperation and active learning experiences—appeared to be related to student perceptions of learning gains at bachelor's and doctoral-granting institutions. These findings were based on responses in 1990 and 1994 to the College Student Experiences Questionnaire developed by Robert Pace. Koljatic and Kuh (2001) also explored and confirmed the important role of faculty–student interaction in student learning and development. Caboni, Mundy, and Duesterhaus (2002) found that students supported three of the seven principles of good practice: student–faculty interaction, cooperative learning experiences, and high expectations.

Other studies have focused more specifically on the relationship between faculty–student interaction and other educational outcomes of interest. Woodside, Wong, and Wiest (1999) found that student–faculty interactions were related both to students' academic achievement and to self-concept within academics. Pascarella and Terenzini (1980) conducted a seminal study of the Tinto and Spady models of college dropouts; the results supported the critical role of student–faculty interaction in the process of student attrition during college, especially in cases where students were otherwise predicted to leave.

Additional studies support the relationship between active learning and student persistence (Braxton, Olsen, & Simmons 1998; Ramaley & Hagggett, 2005). Students, particularly first-generation students, may benefit from high standards and expectations (e.g., more writing assignments, more hours of study) and a variety of peer interactions, involvement, and engagement. However, students may be less likely to receive exposure to such activities and experiences (Pascarella, Pierson, Wolniak, & Terenzini, 2004).

The examination of changes in undergraduate “learning productivity” from the 1980s to the 1990s to identify potential differences by institution type (from large research-extensive to small liberal arts institutions) may be best exemplified by Kuh and Hu (2001b). Kuh and Hu defined “learning productivity” as the combination of engagement in educationally purposeful activities and the estimated learning gained from such activities. Although their definition combined what can be categorized as both the “environmental” and “output” components of the input-environment-output (I-E-O) model (Astin, 1993), they did seek to identify (a) potential differences in learning productivity of undergraduates at research universities and undergraduates at other types of institutions, (b) whether or not learning productivity had improved at research universities from the 1980s to the 1990s, and (c) whether or not research universities might achieve greater learning productivity among their undergraduates. These authors found an indirect yet positive effect on estimated gains in learning from student–faculty interaction mediated by student effort and other educational experiences.

In short, the results of these studies provide broad support for the seven principles of effective practice. However, the literature gives less attention (a) to the relative importance of each practice category while controlling for the effects of all other best practice categories and student background characteristics simultaneously, (b) to consideration of a possible “synergy of best practices” that enhances both student learning and student persistence, and (c) to the potential that particular principles may “matter more” than others at research-extensive institutions. Answers to these questions may

provide a more effective and focused set of strategies and policies to improve undergraduate educational experiences and outcomes at research-extensive institutions within this important sector of postsecondary education. This is especially important given the resource constraints and trade-offs such institutions face as they seek to maximize impact and performance in all facets of their mission to teach (promote learning), conduct research (foster new discoveries), and serve the public good (participate in outreach and engagement activities).

Purposes and Research Questions

This study seeks to extend the range of study of best practices in undergraduate education and the impact of college on students by examining the relationship between best practices (as outlined by the “Seven Principles for Good Practice in Undergraduate Education”) and the critical thinking skills and persistence of undergraduate students at a research-extensive university. The results of this study may be useful to researchers of and leaders at research universities. Both groups seek to understand and enhance academic quality within the context of a complex institutional environment defined by multifaceted missions in teaching, research, and service. Differences in institutional characteristics, such as size and mission, may suggest unique issues and needs related to enhancing the impact of academic programs (Toutkoushian & Smart, 2001). Therefore, faculty, administrators, and students at large, research-extensive institutions may need to focus on particular strategies to enhance institutional impact, student outcomes, and academic quality.

Given these purposes, this study attempted to address the following specific questions:

1. What is the relationship between engagement in best practices and institutional contributions to critical thinking and the likelihood of persistence?
2. Do particular best practices appear to be most important to enhancing student critical thinking and persistence?

3. Do such practices suggest common, complementary, or contradictory paths for institutional practices and policies to enhance critical thinking and persistence?
4. What are the implications of the results for researchers, institutional leaders, faculty members, and undergraduate students at research-intensive universities?

Data and Methodology

This study employed a nonexperimental, correlational research design to analyze a set of cross-sectional NSSE survey responses from more than 1500 first-year and senior students at a large, research-intensive university during the spring of 2004. There were a total of 2,012 responses (response rate=34%) of the initial students randomly selected and invited to participate. There was a sampling error of $\pm 2\%$. Cases with missing data were removed from the analysis. The overall respondents reflected larger percentages of minority students compared to the overall population of first-year and senior students due to intentional oversampling to allow for analysis of subgroups by ethnicity. The sample and respondent characteristics are provided in Table 1. The use of first-year and senior student subsamples reflects NSSE's sampling strategy to enable institutions to examine differences between first-year students and seniors as well as facilitate comparisons among various benchmark groups. It also provides a snapshot of the critical first-year experience as well as a "summative" perspective for those who persist to the senior year.

The NSSE questionnaire is designed and constructed carefully to ensure reliability and validity. The instrument's conceptual framework and psychometric properties also exhibit strong validity and reliability based on both statistical tests and feedback from various experts and students (Kuh, 2003; Pike & Kuh, 2005). In addition, the questionnaire is designed to minimize factors known to adversely affect the validity of responses, especially in light of the challenges associated with self-reports by students (Pike 1993, 1995, 1996, 1999). Limiting the reference point for responses to the current academic year and asking for indicators of frequency for specific experiences,

practices, and behaviors (items that respondents can understand and report) serve to enhance the reliability and validity of the responses.

In order to explore multiple and distinct dimensions of institutional impact on undergraduate students, two models employing binary logistic regression analysis were developed and tested. One model was designed to explain student self-reports of the institution's contribution to their critical thinking skills; the second was designed to explain student likelihood of persistence (or returning to the institution). The questionnaire items were selected based on their face validity as proxy measures that reflect the fundamental concepts underlying Chickering and Gamson's "Seven Principles for Good Practice in Undergraduate Education." Both models were estimated using SPSS 14.0 for Windows.

The researcher recognized the relationship that particular immutable characteristics of students and their backgrounds (both at the level of the individual student and, in the short-run, at a group level via change over time) can have with their collegiate experiences and the impact of those experiences (Astin, 1993; Bean, 1980; Braxton, 2000; Pascarella & Terenzini, 1991a, 1991b; Tinto, 1975, 1993). Thus, each model controlled for academic preparation/background using ACT and SAT-converted test scores (Marco, Abdel-fattah, & Baron, 1992), gender, minority status, full-time/part-time enrollment status, class rank, place of residence, self-reports of typical grades earned in classes, and major. The variables and factors for both models, including their respective question items and coding, are listed in Table 2.

TABLE 1 | Sample Characteristics and Response Rate (percentages within each category)

	First Year	All	Senior
Response rate			
Overall		34%	
By class	36%		32%
NSSE sample size	2,426		3,537
Sample error			
Overall		2.0%	
By class	3.0%		2.7%
Number of respondents	882		1,139
Total population	6,003		10,597
Student characteristics			
<i>Mode of completion</i>			
Paper	0%		0%
Web	100%		100%
<i>Gender</i>			
Female	60%		58%
Male	40%		42%
<i>Race/Ethnicity</i>			
African American/Black	15%		13%
American Indian/Native American	1%		1%
Asian American/Pacific Islander	13%		27%
Caucasian/White	60%		48%
Hispanic or Latino	3%		4%
Other	0%		1%
Multiracial	8%		7%
International/Foreign national	7%		17%
<i>Class level</i>	44%		56%
<i>Enrollment status</i>			
Full time	99%		90%
Part time	1%		10%
<i>Place of residence</i>			
On campus	86%		8%
Off campus	14%		92%
<i>Transfer status</i>			
Transfer students	6%		33%
<i>Age</i>			
Nontraditional (24 or older)	0%		23%
Traditional (less than 24)	100%		77%

* SOURCE: NSSE Institutional Respondent Characteristics Report, 2004

TABLE 2 | Independent, Dependent, and Control Variables

Independent “Seven Principle” Variables		
Variable	SSE Item	Unit of Measure
FACIDEAS (Faculty/Student interaction)	Discussed ideas from class with faculty members outside of class	1=Never; 2=Sometimes 3=Often; 4=Very often
OCCGRP (Cooperative learning)	Worked with classmates outside of class	1=Never; 2=Sometimes 3=Often; 4=Very often
CLQUEST (Active learning)	Asked questions or participated in class discussions	1=Never; 2=Sometimes 3=Often; 4=Very often
FACFEED (Prompt feedback)	Received prompt feedback from faculty on academic performance	1=Never; 2=Sometimes 3=Often; 4=Very often
WORKHARD (Institution communicates high expectations)	Worked harder than you thought you could to meet an instructor's expectations	1=Never; 2=Sometimes 3=Often; 4=Very often
DIVLRN (Respect for diverse talents and ways of learning)	Participated in a community service project as part of a course	1=Never; 2=Sometimes 3=Often; 4=Very often
STUDY (Time on task)	Number of hours per week typically spent preparing for class	1=None; 2=1 – 5 hours . . .8=30 or more hours
Dependent Variables		
CRITICAL (model)	Institutional contribution to thinking critically and analytically	0=Some/Very little 1=Quite a bit/Very much
RETURN (model)	If starting over, would you return to the same institution you currently attend?	0=No/Probably not 1=Probably yes/Yes
Control Variables		
FT/PT	Thinking about this current academic term, how would you characterize your enrollment?	0=Part time 1=Full time
GRADES	What have most of your grades been up to now at this institution?	1=C or lower . . .8=A
RESIDENCE	Which of the following best describes where you are living now while attending college:	1=Dormitory 2=Walking distance or Greek house; 3=Driving distance
GENDER		0=Male; 1=Female
1ST YEAR/SR		1=First year; 4=Senior
ACADEMIC PREPARATION		Converted score for ACT or SAT
ETHNICITY	Race or ethnicity	Categorical
COLLEGE MAJOR	Primary college of major	Categorical

Results and Discussion

The following tables present the statistical results for both models. Table 3 provides summary statistics for each model including sample sizes (“n” or number of observations in the sample) as well as the Cox-Snell and Nagelkerke R² statistics. Tables 4 and 5 provide the regression results for the CRITICAL (critical thinking) and LIKELY RETURN (likelihood of returning if starting over) models, respectively. These results include levels of statistical significance for the control variables and independent variables of interest as well as the odds ratio for each.

TABLE 3 | Model Summaries

	Cox – Snell	2 log likelihood	F	n
CRITICAL	.092	.147	1360.424	1,536
LIKELY RETURN	.064	.109	1247.278	1,536

TABLE 4 | LIKELY RETURN Model Results

Variable	Exp (B)	Significance Level
Students		
ACT	1.031	n.s.
GENDER	1.218	n.s.
ETHNICITY	1.082 – 2.689	n.s.
COLLEGE MAJOR	1.087 – 4.060	p<.01 (Engineering)
1ST YEAR/SENIOR	.862	n.s.
FT/PT	1.087	n.s.
RESIDENCE	.188 – .314	n.s.
GRADES	1.079	n.s.
Best Practices		
CLQUEST*	1.102	n.s.
OCCGRP**	1.191	n.s.
DIVLRN	.975	n.s.
FACIDEAS	.950	n.s.
FACFEED**	1.349	p<.01
WORKHARD	.899	n.s.
STUDY	.959	n.s.

TABLE 5 | CRITICAL Model Results

Variable	Exp (B)	Significance Level
Students		
ACT	.970	n.s.
GENDER	1.133	n.s.
ETHNICITY	.801 – 1.087	n.s.
COLLEGE MAJOR	1.936 – 3.064	n.s.
1ST YEAR/SENIOR	.944	n.s.
FT/PT	.651	n.s.
RESIDENCE	.373 – .536	n.s.
GRADES	.984	n.s.
Best Practices		
CLQUEST*	1.220	p<.05
OCCGRP**	1.316	p<.01
DIVLRN**	.803	p<.01
FACIDEAS	1.059	n.s.
FACFEED***	1.554	p<.001
WORKHARD***	1.422	p<.001
STUDY	1.052	n.s.

For both models, student background characteristics did not increase or decrease significantly the likelihood of high or low ratings of institutional contribution to critical thinking. The same was true for the likelihood of persistence to degree as measured by students' self-reported likelihood of returning to the same institution if they were starting over. The increased likelihood of persistence for engineering majors is one exception.

In the LIKELY RETURN model, students who reported receiving prompt feedback from faculty on academic performance more frequently had a significantly higher probability of persisting. However, asking questions or contributing to class discussions, working with classmates outside of class, working harder than you thought you could to meet an instructor's expectations, and receiving prompt feedback from faculty on academic performance increased the likelihood of reporting that the institution contributed to one's critical thinking skills. Surprisingly, working on a community-based project as part of a class was associated with a lower

likelihood of reporting that the institution contributed to one's critical thinking and analytical skills. This finding warrants additional attention in future studies and may be explained by other factors outside the scope of this study.

These results provide some interesting answers to the research questions raised in this study. Specifically, certain practices do appear to matter more than others for this institution and in fact may represent evidence of the need to explore distinct, institution-specific (and possibly program specific) correlates with various student and institutional outcomes. With additional analysis, the extent to which there are distinctions across institution types could be tested as well. Specifically, the findings suggest that the likelihood of student persistence (satisfaction) and self-reported gains in critical thinking are supported by a common explanatory variable—prompt feedback on academic performance. Finally, student characteristics and background appear to be less important than student and institutional behaviors and practices during college as sources of variation in student persistence, satisfaction, and self-reported gains in critical thinking and analytical reasoning. This supports Kuh's (2001) conclusion that what students do in college matters more than who they are or from where they come.

In the context of the research literature, this study provides additional support for certain findings. In particular, (a) faculty–student interaction (Braxton, Olsen, & Simmons, 1998; Caboni, Mundy, & Duesterhaus, 2002; Koljatic & Kuh, 2001; Kuh & Hu, 2001a, 2001b; Kuh, Pace, & Vesper, 1997), (b) high expectations and (c) active learning experiences (Kuh & Vesper, 1997; Kuh, Pace, & Vesper, 1998) receive the most support given the consistent lack of significant relationships between student characteristics and students' estimates of both the institutional contribution to their critical thinking skills and their self-reports of the likelihood they would return to the same institution if starting over. However, there are some divergent findings. Braxton, Olsen, and Simmons did not find that students prefer or support active learning and high expectations as best practices, although this does not necessarily mean these practices are not effective. At the same time, evidence for the importance of active learning and high expectations (along with prompt feedback) was restricted to the CRITICAL model. However, Caboni, Mundy, and Duesterhaus found support for high expectations as well. Carini, Kuh, and

Klein (2006) also found that student engagement is positively related to grades and critical thinking outcomes. In those results, when student characteristics and engagement in best practices were included, grades were not related (a) to student self-reports of the institutional contribution to critical thinking or (b) to students' self-reports of the likelihood they would return to the same institution if starting over. Secondly, Carini, Kuh, and Klein concluded that students with lower entrance test scores benefit more from student engagement. Although students with lower ACT/SAT scores may attribute greater institutional effects on their personal development, they do not differ significantly from students with higher entrance test scores in their estimates of institutional contributions to their learning here.

Another difference between this and other studies is the attempt to measure and include a broader set of best practice principles within a single analysis. This approach can serve as a useful analytic strategy to inform policies and identify practices that have the strongest relationships to various outcomes of mutual interest that represent student success. This method also represents a strong test for the explanatory and predictive validity of the best practice principles, especially when the influences of other known student and institutional variables are controlled.

Finally, future studies might attempt to connect findings from a broad institutional perspective with action research at the course or program level, such as a pretest and posttest design or focus groups with groups that report various levels of engagement in different dimensions of best practice. These approaches could reveal even more specific insights for researchers and those working in higher education settings to better understand and identify the combination of strategies most likely to enhance student outcomes, given limited resources.

Universities, accrediting agencies, and state and federal governments may also find these results worthwhile as one small example of using a “research-based lens” to explore new policies aimed at improving undergraduate student success. For research-extensive institutions, consideration of strategies to enhance cooperation and interaction between instructors of all kinds and their students is crucial to enhancing student learning and development outcomes.

However, the increased use of part-time instructors—shaped by concurrent pressures and needs to maximize efficiency and effectiveness in instruction, generate external research funding, and produce publications—may in some cases present serious challenges to enhancing interaction between instructors and students. In these cases, innovative means to enhance interaction, feedback, and communication between students and faculty may be worth additional consideration. This may be exemplified best in the dramatic gains in student learning as a result of various versions of “course redesign” as developed and supported via the National Center for Academic Transformation (NCAT, 2005). In addition to NCAT's own evidence of increased student performance via lower cost redesign of large enrollment courses, Nelson-Laird's (2004) findings support the positive relationships between technology use and learning. Given the relationship between faculty feedback on academic performance (promptness and frequency) in both the persistence and the development of critical thinking models, enhancing these interactions via technology may enhance student learning via the increased opportunities to assess, correct, and improve throughout the course. Enhancing interactions also may serve as an important signal to students of the attention being paid to their academic performance by instructors and the institution overall. This may have important implications for student feelings toward the university and, in turn, their performance and persistence.

Second, additional survey research should attempt to identify the specific policies and practices that support the positive relationship between the likelihood of persistence and enrollment as an engineering major. Insights gained from this research may provide a basis for action steps that other departments can test and adapt both within and across institutions. The national accrediting body for engineers, ABET, may also be able to provide a means for communicating these kinds of insights to other accrediting bodies, both institutional and professional, and to other disciplinary associations.

The lack of a significant relationship between DIVLRN (community service in a course) and students' self-ratings for persistence/satisfaction represents an unexpected result given prior findings (Astin et al., 2000). It may be the case that the incidence of service learning represents a proxy for other facets of programs in which community service or service learning take place more

often than others—and possibly the need to enhance critical reflection and integration based on these active, practical experiences. Also, as Astin suggests, service learning in courses appears to facilitate additional discussion. This aspect of best practice may be captured by other variables in the model.

The “midterm and final exam” format of assessing and providing feedback on student learning within the context of a passive lecture course may be the least productive model for enhancing student persistence and critical thinking.

Finally, the “midterm and final exam” format of assessing and providing feedback on student learning within the context of a passive lecture course may be the least productive model for enhancing student persistence and critical thinking. However, this framework retains its status as a common approach to undergraduate instruction. In order to transform these approaches into more productive and effective strategies, institutions and those who support higher education might explore new ways to embed incentives and improve training for instructors and future faculty. Employing research-based practices, these individuals could increase integration and use of information technology to facilitate feedback and active learning (especially in environments where resources constrain the ability to add staff), and utilize student peers and others to provide input and feedback. The potential impact of research experiences—a seemingly obvious comparative advantage for research universities—as a mechanism to enhance student–faculty interaction, regular feedback, and high expectations at the undergraduate level may represent the ultimate strategy for students and institutions to pursue.

Limitations

Although the results of this study point to a set of interesting findings for research-extensive institutions, there are limitations to keep in mind. First, this study was conducted based on a single institution at a single point in time, and the results may have limited application to other institutions. More studies of research-extensive institutions and institutions representing other classifications will be required to determine whether different forms or patterns of engagement in best practices matter more than others in terms of student learning and development and whether those relationships vary across institution types. Although the results of this study do suggest that students who differ in a variety of ways nonetheless benefit in similar ways from engaging in and being presented with programs and experiences that implement best practices, those best practices may not have equal impact. They also do not provide a means to conclude that these same results would hold for different students across the variety of institutions as defined by the traditional Carnegie classification system. With a new and more nuanced scheme of institutional classification being implemented by the Carnegie Foundation, the possibilities for even finer (and possibly more appropriate) distinctions across a variety of institutional and student characteristics will be possible.

Second, this study is limited by available data and statistical techniques selected. Other researchers and institutional analysts should be encouraged to move beyond descriptive results, broad comparisons with other institutions, and the techniques used in the study by employing different statistical techniques with a variety of samples and data sets and different research designs such as in-depth interviews and true experimental studies. Although benchmarking and intrainstitutional comparisons can be helpful, they can be more helpful when combined with a better understanding of the relationships between what happens during the college experience and outcomes of interest. Expanding a research-based approach also may enhance the level of involvement of faculty members at research-extensive universities who are more likely to express interest in an approach to improvement that more closely resembles the paradigm that shapes the way they conduct research in their own disciplines, and, in turn, makes it more likely they will pursue changes based on their new knowledge.

Third, the NSSE survey is administered in the spring. At that point in the academic year, a number of students (notably first-year students) have already left the institution and taken a potentially important source of information along with them. Future attempts to explore these missing cases might be a fruitful line of inquiry.

Fourth, there can be differences between respondents and nonrespondents (Porter & Whitcomb, 2005). In this study, students who participated and had a complete set of responses were more likely to be white, female, live on campus, and enrolled full time (based on chi-square and Mann-Whitney tests of mean rank differences). However, these characteristics were controlled in both models.

Fifth, the role of student personality (Dollinger, 2000), motivation, and other background and institutional variables may introduce some amount of omitted-variable bias in these models. Although variables selection was guided by theory and prior research, the integration of additional components found within psychological, social, institutional, and economic models could enhance the explanatory power of “institutional impact” models such as those used in this study. Efforts to integrate key components of different perspectives into a more unified model may help unite various research programs and agendas to provide a richer context for examining a complex process. Here, mixed methods approaches may help connect model components and explore casual and temporal links within a more unified “quality” or “institutional impact” model of undergraduate education (Cabrera & Castenada, 1993). These models also might include components of research productivity and outreach to further integrate and better identify leverage points and sticking points across various outcome and mission areas.

Finally, the development of factor scores for each best practice principle via the data sets NSSE provides to participating institutions will enable researchers to compare and contrast multiple dimensions of each principle across institutions, subpopulations of students, and programs. This may help to address the limitations associated with using single-items as proxy measures.

Conclusion

To summarize these findings within the context of the Chickering and Gamson framework and the main research questions, the results suggest that the quality and amount of student–faculty interaction via feedback on academic performance and high academic expectations are critical best practice predictors of student success within a large, research-extensive university environment. Determining whether this finding may be different for other institution types (after controlling for student characteristics and the unique contributions of other best practices) will require additional study across multiple categories of institutions on a larger scale. However, for institutions with complex missions and large-scale operations in instruction, research, and public service, the application of theoretical frameworks and methods of inquiry to assess priorities and identify key leverage points to improve undergraduate education represents an approach that applies well-established principles of scholarship and research. In addition, such an approach may help individual institutions identify the particular principles and practices that are most likely to support key student and institutional goals in ways that link the resources and strengths of research-extensive institutional environments with student needs. Further inquiry by researchers and innovation by institutional leaders and policymakers based on research along the lines suggested by this study appear warranted.

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References

- Astin, A. W. (1993). *What matters in college: Four critical years revisited*. San Francisco: Jossey-Bass.
- Astin, A. W. et. al. (2000). *How service learning affects students*. Los Angeles: Higher Education Research Institute at <http://www.gseis.ucla.edu/heri/PDFs/HSLAS/HSLAS.PDF>
- Bean, J. P. (1980). Dropouts and turnover: The synthesis and test of a causal model of student attrition. *Research in Higher Education, 12*: 155–187.
- Braxton, J. M. (2000). *Reworking the student departure puzzle* (1st ed.). Nashville, TN: Vanderbilt University Press.
- Boyer Commission on Educating Undergraduates in the Research University (1998). *Reinventing undergraduate education: A blueprint for America's research universities*. Retrieved March 2005 from: [http://naples.cc.sunysb.edu/Pres/boyer.nsf/673918d466bf653e852565ec0056ff3e/d955b61ffddd590a852565ec005717ae/\\$FILE/boyer.pdf](http://naples.cc.sunysb.edu/Pres/boyer.nsf/673918d466bf653e852565ec0056ff3e/d955b61ffddd590a852565ec005717ae/$FILE/boyer.pdf)
- Braxton, J. M., Olsen, D., & Simmons, A. (1998). Affinity disciplines and the use of principles of good practice for undergraduate education. *Research in Higher Education, 39*(3): 299–318.
- Cabrera, A. F. & Castenada, M. B. (1993). The convergence between two theories of college persistence. *Journal of Higher Education, 63*: 143–164.
- Carini, R. M., Kuh, G. D., & Klein, S. P. (2006). Student engagement and student learning: Testing the linkages. *Research in Higher Education, 47*(1): 1–32.
- Caboni, T. C., Mundy, M. E., & Duesterhaus, M. B. (2002). The implications of the norms of undergraduate students for faculty enactment of principles of good practice in undergraduate education. *Peabody Journal of Education, 77*(3): 125–137.
- Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin, 37*(7): 3–7.
- Chickering, A. W., & Gamson, Z. F. (1999). Development and adaptation of the seven principles of good practice in undergraduate education. *New Directions for Teaching and Learning, 80*: 75–81.
- Dollinger, S. J. (2000). Locus of control and incidental learning: An application to college student success. *College Student Journal, 34*(4): 537–540.
- Ewell, P. T. & Jones, D. (1996). *Indicators of good practice in undergraduate education: A handbook for development and implementation*. Boulder, CO: National Center for Higher Education Management Systems.

- Koljatic, M., & Kuh, G. D. (2001). A longitudinal assessment of college student engagement in good practices in undergraduate education. *Higher Education, 42*(3): 351–371.
- Kuh, G. D. (1995). The other curriculum: Out of class experiences associated with student learning and development. *Journal of Higher Education, 66*(2): 123–155.
- Kuh, G. D. (2001). College students today: why we can't leave serendipity to chance. In Altbach, P., Gumpert, P., and Johnstone, B. (Eds.), *In defense of the American University* (pp. 277–303). Baltimore: Johns Hopkins University Press.
- Kuh, G. D. (2003). The National Survey of Student Engagement: Conceptual framework and overview of psychometric properties. Retrieved December 2005 from http://www.indiana.edu/~nsse/pdf/conceptual_framework_2003.pdf
- Kuh, G. D. & Hu, S. (2001a). Learning productivity at research universities. *The Journal of Higher Education, 72*(1): 1–28.
- Kuh, G. D. & Hu, S. (2001b). The effects of student–faculty interaction in the 1990s. *The Review of Higher Education, 24*: 309–332.
- Kuh, G. D., Pace, C. R., & Vesper, N. (1997). The development of process indicators to estimate student gains associated with good practices in undergraduate education. *Research in Higher Education, 38*(4): 435–454.
- Kuh, G. D. & Vesper, N. (1997). A comparison of student experiences with good practices in undergraduate education between 1990 and 1994. *Review of Higher Education, 21*(1): 43–61.
- Marco, G. L., Abdel-fattah, A. A., & Baron, P. A. (1992). Methods used to establish score comparability on the enhanced ACT assessment and the SAT (College Board Report No. 92–3). New York, NY: The College Board. *National center for academic transformation*. Retrieved February 2007 from <http://www.center.rpi.edu/>
- National Survey of Student Engagement (2001). *NSSE Technical and Norms Report*. Indiana University Center for Postsecondary Research and Planning.
- Nelson-Laird, T. (2004). Student experiences with information technology and their relationship to other aspects of student engagement. *Research in Higher Education, 46*(2): 211–233.
- Pace, C. R. (1984). *Measuring the quality of college student experiences*. Los Angeles: University of California, Los Angeles, Center for the Study of Evaluation.
- Pascarella, E.T., Pierson, C.T., Wolniak, G.C., & Terenzini, P.T. (2004). First generation college students: Additional evidence on college experiences and outcomes. *Journal of Higher Education, 75*(3): 249–284.
- Pascarella, E. T. and Terenzini, P. T. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. *Journal of Higher Education, 51*(1): 60–75.

- Pascarella, E. T. & Terenzini, P. T. (1991a). Toward the validation of Tinto's model of college student attrition: A review of recent studies. *Research in Higher Education*, 12(3): 271–282.
- Pascarella, E. T. & Terenzini, P. T. (1991b). *How college affects students: Findings and insights from twenty years of research*. San Francisco: Jossey-Bass.
- Pike, G. R. (1993). The relationship between perceived learning and satisfaction with college: An alternative view. *Research in Higher Education*, 34: 23–40.
- Pike, G. R. (1995). The relationships between self reports of college experiences and achievement test scores. *Research in Higher Education*, 36: 1–22.
- Pike, G. R. (1996). Limitations of using students' self-reports of academic development as proxies for traditional achievement measures. *Research in Higher Education*, 37: 89–114.
- Pike, G. R. (1999). The constant error of the halo in educational outcomes research. *Research in Higher Education*, 40: 61–86.
- Pike, G. R. (2004). Measuring quality: A comparison of U.S. News rankings and NSSE benchmarks. *Research in Higher Education*, 45(2): 193–208.
- Pike, G. R. & Kuh, G. D. (2005) A typology of student engagement at American colleges and universities. *Research in Higher Education*, 46(2): 189–205.
- Pike, G. R., Kuh, George D. & Gonyea R. M. (2003). The relationship between institutional mission and students' involvement and educational outcomes. *Research in Higher Education*, 44(2): 241–261.
- Porter, S. R. & Whitcomb, M. E. (2005). Non-response in student surveys: The role of demographics, engagement and personality. *Research in Higher Education*, 46(2): 127–152.
- Ramaley, J. A. & Hagggett R. R. (2005). Engaged and engaging science: a component of a good liberal education. *Peer Review*, 7:8–12.
- Spady, W. (1971). Drop-outs from higher education: Toward an empirical model. *Interchange*, 1: 38–82.
- Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45: 89–125.
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago: University of Chicago Press.
- Toutkoushian, R. K. & Smart, J. C. (2001). Do institutional characteristics affect gains from college? *The Review of Higher Education*, 25(1): 39–61.
- Umbach, P. D. & Wawrzynski, M. R. (2005). Faculty do matter: The role of college faculty in student learning and development. *Research in Higher Education*, 46(2): 153–181.

U.S. Department of Education (2006). A test of leadership: Charting the future of U.S. higher education (pre-publication version). Washington, DC: Commission on the Future of Higher Education. <http://www.ed.gov/about/bdscomm/list/hiedfuture/reports/pre-pub-report.pdf>

U.S. News and World Report (2002–2005). *America's Best Colleges*.

Woodside, B., Wong, E., & Wiest, D. (1999). The effect of student-faculty interaction on college students' academic achievement and self-concept. *Education*, 119, 730–734.