The Conditional Nature of High Impact/Good Practices on Student Learning Outcomes

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Using a multi-institutional sample of undergraduate students, this study found that the relationships between engaging in high impact/good practices and liberal arts outcomes differ based on students' precollege and background characteristics. Findings suggest that high impact/good practices are not a panacea and require a greater degree of critical evaluation by higher education scholars.

Increasingly, the public is calling for U.S. higher educational institutions to be held accountable for student learning (McPherson & Schulenberger, 2006a). From the Spellings Commission report (U.S. Department of Education, 2006) to the Voluntary System of Accountability (McPherson & Schulenberger, 2006b; Voluntary System of Accountability, n.d.), colleges and universities are under pressure to demonstrate the soundness of higher education's return on investment. Recent metrics framing this conversation include student learning and the environments and experiences within the college milieu that contribute to student learning (Arum & Roksa, 2011; Pascarella, Blaich, Martin & Hanson, 2011; Pascarella, Seifert & Blaich, 2008, 2010). Central to the estimation of the impact of college on student learning is the recognition that

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students' background characteristics including their academic preparedness, motivation, and orientations toward learning may affect in-college processes and outcomes (Astin, 1991; Pascarella, 1985). Using these college impact frameworks, a small body of research suggests the relationship between postsecondary engagement in high impact/good practices and student learning outcomes may differ based on student demographic and background characteristics (Cruce, Wolniak, Seifert, & Pascarella, 2006; Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008).

As the public's interest in and demand for student learning increases, the need for researchers to question the models, measures, and analytic practices used in college impact research takes on new urgency and is one of the key tasks for the critical quantitative researcher (Stage, 2007). The other task is to "use data to represent educational processes and outcomes on a large scale to reveal inequities and to identify social or institutional perpetuation of systemic inequities in such processes and outcomes," (p. 10) with equity being the central goal (Stage, 2007). If higher education is to live up to its potential to democratize opportunity and mitigate social inequities, the higher education research community must question and modify theoretical and conceptual models to maximize their utility to transform higher education policy and practice. More methodologically complex models not only contribute to refining theory; they tend to yield more nuanced results. Empirical evidence that points to certain experiences as having greater influence on outcomes for certain subgroups can be brought to bear in developing targeted interventions and initiatives as opposed to a "one size fits all" approach. In this regard, substantive program and policy improvements may rise from greater methodological sophistication. Using a longitudinal multi-institutional sample of students attending U.S. colleges and universities, this study examined the extent to which relationships between engagement in high impact/good practices and effective reasoning and problem solving as well as inclination to inquire and lifelong learning were consistent across student groups, or if the magnitude and direction of the relationships varied by student characteristics. We assert the value of methodologically complex models in discussing the practical implications of these more nuanced results.

Literature Review

Principles of Good Practice

Though an extensive body of scholarly work has considered the efficacy of postsecondary programs and initiatives, Chickering and Gamson

(1987, 1991) were the first to synthesize a coherent list of principles of good practice in undergraduate education. The principles—(a) student-faculty contact; (b) cooperation among students; (c) active learning; (d) prompt feedback to students; (e) time on task; (f) high expectations; and (g) respect for diverse students and diverse ways of knowing—have subsequently become highly influential in college impact research, and higher education more generally. For instance, the items that comprise the National Survey of Student Engagement (NSSE) are an operationalized version of Chickering and Gamson's principles of good practice (Kuh, 2001).

Since their introduction, the seven principles of good practice have been subjected to rigorous empirical examination. By and large, the results of these studies have supported the assertion that "various measures of the good practice dimensions are significantly and positively linked to desired aspects of cognitive and non-cognitive growth during college" (Pascarella et al., 2006, p. 254). Extensive research, particularly during the 1990s, examined the degree to which good practices affected student outcomes and supported the predictive validity of specific principles of good practice such as diversity experiences (Gurin, Dey, Hurtado, & Gurin, 2002; Gurin, Nagda, & Lopez, 2004; Pascarella, Palmer, Moye, & Pierson, 2001); student-faculty contact (Kuh & Hu, 2001; Terenzini, Springer, Pascarella, & Nora, 1995); and cooperation among students (Cabrera et al., 2002). (For an exhaustive list of individual validations studies, see Pascarella et al., 2006.) However, most validation studies assessed only one good practice and failed to account for the confounding influence of exposure to other good practices. Furthermore, good practice research has been conducted usually within a single institutional sample, greatly limiting researchers' ability to generalize findings. To remedy these limitations, recent studies of good practices have used multi-institutional, longitudinal datasets to assess the impact of good practice across different types of institutions (see Cruce et al., 2006; Pascarella et al., 2006; Pascarella, Seifert, & Blaich, 2008; Pascarella, Seifert, & Blaich, 2010; Pascarella, Wolniak, Cruce, & Blaich, 2004; Seifert, Drummond, & Pascarella, 2006; Seifert, Goodman, et al., 2007; Seifert, Pascarella, et al., 2007; Whitt et al., 2008).

Although this new wave of research has arrived at conclusions similar to those reached by the initial validation work done during the 1990s, the picture of good practices in undergraduate education has become more nuanced. A small number of studies have examined the extent to which institutional context influences how students with varying background characteristics experience good practices (Seifert et al., 2006;

Seifert et al., 2010). In a study replicating Pascarella and colleagues' (2005) findings from data collected in the 1990s, Seifert and colleagues (2010) found students at liberal arts colleges experienced good practices, particularly those within the classroom, more than their peers at regional and research universities. Other research (Cruce et al., 2006; Pascarella et al., 2006) has examined the conditional role of institutional context and experiences of good practices on student learning. For instance, using data from the 1990s collected as part of the National Survey of Student Learning, Cruce and others (2006) found the relationship between various good practices and educational outcomes differed by the type of institution attended. Whereas effective teaching and interaction with faculty increased the odds of aspiring toward a graduate degree for students at research universities, interactions with peers had a positive relationship with mathematics knowledge only for students at the community colleges in the study.

Despite the recent interest in the role of institutional type in good practices in undergraduate education, few studies have examined whether all students benefit from good practices in similar ways. For example, do women and men benefit from cooperative learning experiences in the classroom to the same degree? Does working on research with a faculty member have similar positive relationships with student outcomes irrespective of a student's background characteristics? The extant literature is only beginning to examine these issues.

Conditional Effects by Student Background Characteristics

To address questions like the ones posed above, researchers must differentiate between the general and conditional effects of a given student experience on a corresponding student outcome. General effects are equivalent in magnitude and direction for all members of a particular sample, whereas conditional effects imply that certain subgroups in the sample are affected to a greater or lesser extent by the program or experience in question. To illustrate: suppose we examine the impact of time spent studying on first-year students' GPA. If time spent studying has a general positive effect on first-year college GPA (assuming we controlled for all confounding influences), all college first-year students in the sample would experience the same increase in GPA for each additional hour per week spent studying. However, if students enrolled in a particular study-skills course (in which they learned techniques to maximize their focus when studying) experience a greater net positive relationship on first-year GPA for each additional hour spent studying per week, we would say that the effect of time studying on GPA is at least partially conditional upon participation in the study skills course.

(For an in-depth discussion of general versus conditional effects in regression modeling, see Pascarella & Terenzini, 1991, pp. 657–691.) This logic can be applied to the effects of good practices on desired student outcomes.

Ample research has uncovered differences in student experiences and outcomes based on race, gender, and socioeconomic status (Pascarella & Terenzini, 2005), but these studies tend to focus on a single college experience or activity (e.g., living in a residence hall, majoring in engineering, participating in student government). A smaller body of research has examined conditional effects of good practices on a number of desired college outcomes. For instance, in an examination of three dimensions of good practice (effective teaching and interaction with faculty, peer interactions, challenge/high expectations) during the first year of college, Cruce and colleagues (2006) found certain effects of good practices were moderated by students' background characteristics such as gender, race, tested academic preparation, pretest scores on outcomes of interest, as well as institutional type. Similarly, Kuh (2009) described differential impact of student engagement on student-reported gains based on background characteristics, including race. Most recently, Loes, Pascarella, and Umbach (2012) found that the effect of interactional diversity experiences on end of first-year critical thinking was conditional upon precollege academic preparation and race, with students in the lowest precollege academic preparation group and White students showing the greatest gains in critical thinking.

Despite the methodological rigor of these and other studies of the conditional effects of good practice, the present study contributes to the extant college impact literature in a number of ways. First, we systematically investigated the presence of conditional effects between student background characteristics and experiences of good practices on a number of cognitive outcomes. Second, we used longitudinal data that encompassed four years of college attendance in an effort to best estimate "college impact" in the fullest sense of the term. Finally, these data come from a multi-institutional sample of four-year colleges and universities from across the United States, allowing the reader to make more plausible inferences of generalizability. Given the accountability-oriented milieu in which institutions of higher education find themselves (Voluntary System of Accountability, n.d.), research that systematically investigates and questions the degree to which the relationships between good practices and student learning outcomes are similar across student subgroups is both timely and necessary. Moreover, institutions are being called upon to use empirical evidence to improve programs and practices such that the "value add" of the college experience is tangible.

Research that disaggregates by student subgroup populations allows for more targeted and potentially fruitful interventions. As institutions commit resources to improve the learning experience for all of its students, it would appear essential that institutions make decisions based on evidence that has examined the extent to which certain practices may benefit some students more than others. This article provides such analysis.

Methods

Samples

Institutional Sample. The overall sample in the study consisted of incoming first-year students at 17 four-year colleges and universities located in 11 different states from general regions of the United States: Northeast/Middle-Atlantic, Southeast, Midwest, and Pacific Coast. Institutions were selected from more than 60 colleges and universities responding to a national invitation to participate in the Wabash National Study of Liberal Arts Education (WNS). Funded by the Center of Inquiry in the Liberal Arts at Wabash College, the WNS is a large, longitudinal investigation of the effects of liberal arts colleges and liberal arts experiences on the cognitive and personal outcomes theoretically associated with a liberal arts education. The institutions were selected to represent differences in college and universities nationwide on a variety of characteristics including institutional type and control, size, selectivity, location, and patterns of student residence. However, because the study was primarily concerned with the impacts of liberal arts colleges and liberal arts experiences, liberal arts colleges were purposefully overrepresented.

The WNS selection technique produced a sample with a wide range of academic selectivity, from some of the most selective institutions in the country to some that were essentially open admissions. Substantial variability in undergraduate enrollment existed between institutions, with entering classes that averaged 2,975 students (all four-year research universities or four-year regional institutions) to classes that averaged 439 students (all liberal arts colleges). According to the 2007 Carnegie Classification of Institutions, 3 of the participating institutions were considered research universities with very high research activity, 3 were master's universities that granted master's degrees but few if any doctorates, and 11 were baccalaureate liberal arts colleges. All of the liberal arts colleges were private, while 5 of the 6 research universities and comprehensive institutions were public.

Clearly, WNS participating institutions cannot be considered a representative national sample of four-year institutions. Thus, with respect to

generalizing to all four-year institutions, the effects of high impact/good practices must be viewed with caution. Weighed against this, however, is the longitudinal (2006–2010) nature of our data, and the fact we were able to take into account a wide range of potential confounding influences (including precollege scores on each four-year outcome variable).

Student Sample. The individuals in the sample were first-year, full-time undergraduate students attending a WNS participating institution. The initial sample was selected in either of two ways. First, for larger institutions, it was selected randomly from the incoming first-year class at each institution. The only exception to this was at the largest participating institution in the study, where the sample was selected randomly from the incoming class in the College of Arts and Sciences. Second, for a number of the smallest institutions in the study—all liberal arts colleges—the sample was the entire incoming first-year class. Students were invited to participate in a national longitudinal study examining how a college education affects students, with the goal of improving the undergraduate experience. They were informed they would receive a $50 monetary stipend for their participation in each data collection and assured in writing any information provided would be kept in the strictest confidence and never become part of their institutional records.

Data Collection

Initial Data Collection. The initial data collection was conducted in the late summer/early fall of 2006 with 4,193 students and lasted between 90–100 minutes. The data collected included a WNS precollege survey that sought information on student demographic characteristics, family background, high school experiences, political orientation, life/career plans, among other background data. Students also completed a series of instruments that measured dimensions of cognitive and personal development theoretically associated with a liberal arts education. One of these was the 40-minute Collegiate Assessment of Academic Proficiency (CAAP) critical thinking test (CTT). In order to minimize the time required by each student in the data collection, and because another outcome measure was used that required approximately the same administration time, the CTT was randomly assigned to half of the sample. The other two dependent measures in the study—Need for Cognition Scale (NCS) and Positive Attitude toward Literacy (PATL) Scale—were completed by all participating students.

Follow-up Data Collection. Students completed the two-hour follow-up data collection in spring 2010 (approximately four academic years later) and provided two types of data: (1) Extensive information on students' experience of college including classroom activities, study

habits, perceptions of teaching received, cocurricular involvement, interactions with faculty and student affairs staff, interactions with peers, and involvement in diversity experiences; and (2) follow-up (or posttest) measures of the instruments measuring dimensions of cognitive and personal development completed in the initial data collection. Information on students' experience of college was collected prior to information on the posttest measures. The entire data collection was administered and conducted by ACT, Inc. (formerly the American College Testing Program). [A preliminary follow-up data collection was also conducted after the first year of college (Spring 2007). A small number of participants in the 2010 data collection did not participate in the 2007 follow-up. A control for this, in the form of a dummy variable indicating participation/nonparticipation in the 2007 data collection, was built into all analyses. This variable had only a trivial net influence on each outcome.]

Of the original sample of 4,193 students who participated in the 2006 data collection, 2,212 participated in the spring 2010 follow-up data collection, for a response rate of 52.8%. These students represented approximately 10% of the total population of incoming first-year students at the 17 participating institutions. Of these 2,212 students, useable 2010 data for our analyses was available for 998 students on the CTT, 2,063 on the NCS, and 2,067 on the PATL scale. We developed a weighting algorithm to provide some adjustment for potential response bias by sex, race (student of color/White), academic ability, and institution in the samples analyzed. Using institutional records, 2010 follow-up participants were weighted up to each institution's fourth year undergraduate population. While applying weights in this manner has the effect of making the samples more representative of the institutional populations from which they were drawn, this weighting procedure cannot adjust for nonresponse bias. The weighted respondent sample included 44% men, 25% of the sample identified as a student of color, and 42% of the sample had at least one parent with a graduate degree. Due to small sample sizes, we were unable to differentiate meaningfully and reliably by race and ethnicity beyond the dichotomy, White/student of color. We acknowledge this limitation in the data analysis and results.

Guiding Conceptual Model

A number of conceptual models have been offered to guide scholars in understanding the impact of college on students (e.g., Astin, 1991, 1993, Pascarella, 1985; Pascarella & Terenzini, 1991, 2005). These models suggest that in order to accurately estimate the unique influence of any single college experience, one also needs to take into account

three other sets of influences: the individual capabilities, characteristics, and experiences students bring to postsecondary education; the characteristics of the institution attended; and other college experiences which may influence or covary with the influence in question. This general framework guided our modeling process for the variables described in the following sections.

Dependent Variables

Synthesizing much of the literature on liberal arts education, and building on the work of Jones and McEwen (2000), King, Kendall Brown, Lindsay, and VanHecke (2007) developed a comprehensive model of liberal arts outcomes that embraced seven general dimensions: effective reasoning and problem solving, inclination to inquire and lifelong learning, well-being, intercultural effectiveness, leadership, moral character, and integration of learning. This study focuses on estimating the effects of high impact/good practices on the first two dimensions of the King et al. model: effective reasoning and problem solving, and inclination to inquire and lifelong learning.

To tap the dimension of effective reasoning and problem solving, the WNS used the CAAP CTT, developed by the American College Testing Program (ACT). The CTT is a 40-minute, 32-item instrument designed to measure a student's ability to clarify, analyze, evaluate, and extend arguments. The test consists of four passages in a variety of formats (e.g., case studies, debates, dialogues, experimental results, statistical arguments, editorials). Each passage contains a series of arguments that support a general conclusion and a set of multiple-choice test items. The internal consistency reliability for the CTT ranges between .81 and .82 (ACT, 1991) and correlates .75 with the multiple-choice Watson-Glaser Critical Thinking Appraisal (Pascarella, Bohr, Nora, & Terenzini, 1995), and .58 with the performance task of the essay-based Collegiate Learning Assessment (Pascarella, Blaich, Martin, & Hanson, 2011).

Inclination to inquire and lifelong learning were operationalized using two measures. The first was the 18-item NCS. Need for cognition refers to an individual's "tendency to engage in and enjoy effortful cognitive activity" (Cacioppo, Petty, Feinstein, & Jarvis, 1996, p. 197). Individuals with high need for cognition "tend to seek, acquire, think about, and reflect back on information to make sense of stimuli, relationships, and events in their world" (p. 198). In contrast, those with low need for cognition are more likely to rely on others, such as celebrities and experts, cognitive heuristics, or social comparison to make sense of their world. Thus, need for cognition is a general characteristic

of one's interest in inquiry and lifelong learning. In college student samples, Cacioppo and colleagues (1996) found the internal consistency of the NCS ranged from .83 to .91 and correlated positively with students' tendency to generate complex attributions for human behavior, verbal ability, engagement in evaluative responding, one's desire to maximize information gained rather than maintain one's perceived reality

The inclination to inquire and lifelong learning outcome was also operationalized using the 6-item PATL scale. The PATL assesses respondents' interest in reading widely across a variety of genres (poetry and literature, science, history, etc.) as well as writing to develop greater clarity and understanding. These multidisciplinary literacy behaviors are consistent with developing a habit of lifelong learning. The PATL has an internal consistency of .71 and correlates positively with library use, reading books for pleasure, and reading comprehension (Bray, Pascarella, & Pierson, 2004).

The longitudinal pretest-posttest nature of the WNS allows us to estimate gains in each of the outcomes after four years of college without using actual gain scores as the dependent variable. This has been explained and demonstrated empirically by Pascarella, Wolniak, and Pierson (2003). As long as one has a pretest-posttest design with longitudinal data, one does not need a gain score as the dependent variable to actually predict gains. In the presence of a control for the pretest, the regression coefficients and significance tests for all predictors in the equation other than the pretest are exactly the same, irrespective of whether the dependent variable is a simple posttest or a gain/growth score.

Predictor Variables: High Impact/Good Practices

In selecting the high impact/good practices for this study we were conceptually guided by a body of literature and evidence that specifies particular practices and experiences in undergraduate education that are linked to personal and intellectual growth during college (e.g., Astin, 1993; Chickering & Reisser, 1993; Kuh, 2009; Kuh et al., 2008; Pascarella & Terenzini, 1991, 2005). To measure these high impact/good practices, the WNS selected and adapted empirically-vetted scales and items from the National Study of Student Learning (Cruce et al., 2006; Pascarella et al., 2005) and the National Survey of Student Engagement (Kuh, 2001). These scales and items were designed to measure a range of high impact/good practices include such dimensions as doing individual research with a faculty member, quality of faculty-student interaction, quality of teaching received, academic challenge and high expectations, cooperative learning experiences, cocurricular involvement and positive interactions with peers, and involvement in diversity expe-

riences. A growing body of evidence indicates that, even in the presence of statistical controls for important confounding influences, these good practice dimensions are significantly associated with students' cognitive and personal development during college (see Cruce et al., 2006; Kuh, 2009; Pascarella et al., 2005; Pascarella et al., 2006; for reviews of this literature, including specific citations to original studies).

We employed seven different dimensions of high impact/good practices in our study. *Worked with a faculty member on a research project* was a single item in which students responded whether or not they had worked with a faculty member, coded as 0 for "have not done" and 1 for "done." The other six dimensions of high impact/good practices were composite measures, derived using factor analysis and constructed by first standardizing each item and then computing the composite mean across items.

High quality interactions with faculty was a 23-item composite scale ($\alpha = .92$) that combined items on students' perceptions from four subscales: (a) Overall exposure to clear and organized instruction at the institution attended; (b) Faculty interest in teaching and student development; (c) Prompt feedback; and (d) Quality and impact of nonclassroom interactions with faculty. *Academic challenge and high expectations* was a 31-item composite scale ($\alpha = .88$) that combined items on students' perceptions from four subscales: (a) Academic effort; (b) Challenging classes and high faculty expectations; (c) Frequency of higher-order exams and assignments; and (d) Integration of ideas. *Cocurricular involvement and positive interactions with peers* was a 9-item scale ($\alpha = .85$) that measured the number of hours per week students spent in cocurricular activities such as organizations, campus publications, student government, fraternities or sororities, intercollegiate or intramural athletics, etc. as well as the degree to which students reported positive interactions with peers. *Frequency of interacting with faculty and student affairs staff* was a 9-item scale ($\alpha = .83$) based on student self-reports that combined items from two subscales: (a) Frequency of interactions with faculty; and (b) Frequency of interactions with student affairs staff. *Cooperative learning experiences* was a 4-item scale ($\alpha = .70$) based on student self-reports of teaching one another, participating in study groups, etc. *Interactional diversity* was a 9-item scale ($\alpha = .80$) based on student self-reports from two subscales: (a) Diversity experiences; and (b) Meaningful discussions with diverse peers.[1]

Control Variables

Student precollege characteristics and experiences included: a precollege (fall, 2006) measure of each of the three dependent variables; ACT

(or SAT equivalent) score as provided by each institution; sex (male = 1; female = 0); race (student of color = 1; White = 0); parental graduate education (whether or not at least one parent had a graduate degree = 1); a measure of high school social/academic involvement, and a measure of precollege academic motivation.

Our measure of institutional context was attendance at a liberal arts college (vs. a regional institution or research university). We reasoned this to be an important institutional context measure to take into account as attendance at a liberal arts college appears to increase the likelihood that students will be exposed to many of the high impact/good practices operationalized in the study (Pascarella et al., 2004; Seifert et al., 2010).

Finally, since our dependent measures focused on thinking and reasoning skills and continuing motivation for learning, we judged it important that other college experiences be represented by one's major field of study. To do this, we created two dummy variables to represent three basic categories of undergraduate major: (1) social sciences or arts & humanities major; and (2) science, technology, engineering, or mathematics major. All other majors were the comparison group and coded zero. Table 1 presents the descriptive statistics for all study variables.

Analyses

The analyses were carried out in two stages. After computing simple binomial correlations, we first estimated general effects and then conditional effects using OLS regression. To estimate the general net effects of the seven high impact/good practices on the three dependent measures, we regressed end-of-fourth-year (spring 2010) CTT, NCS, and PATL on all of the high impact/good practices and all of the control variables described above. To determine the presence of conditional effects, we added a series of cross-product terms to the general effects equations (Cohen, Cohen, West & Aiken, 2003). For NCS and PATL, we multiplied each of the seven high impact/good practices with the pretest (2006) score, ACT score, race, and sex. Because of the high correlation between ACT score and the pretest (2006) CTT score, we eliminated ACT score from the cross-product terms in the prediction of end-of-fourth-year critical thinking. If, when added to the general effects equations, any set of cross-product terms was associated with a statistically significant increase in explained variance, we disaggregated the sample into separate subsamples to examine the nature of the conditional effect (Aiken & West, 1991). For example, if the set of cross-product terms for pretest and the high impact/good practices significantly added to the explained variance in critical thinking, we disag-

TABLE 1

Operational Definitions of Variables with Weighted Descriptive Statistics[ab]

Variable	Operational Definition	CT Analytic Sample Mean (*SD*)	CT Analytic Sample Min. Max.	NCS and PATL Analytic Sample Mean (*SD*)	NCS and PATL Analytic Sample Min. Max.
Dependent Measures[d]					
Critical thinking (CT)[e]	32-item instrument measures students' ability to clarify, analyze, evaluate, and extend arguments. Cronbach's α ranges from .81 –.82	–.70 (1.03)	–3.53 1.37		
Need for cognition (NCS)	18-item instrument measures degree to which students "seek, acquire, think about, and reflect back on information to make sense of stimuli and events in their world" (Cacioppo, et al., 1996, p. 198). Cronbach's α ranges from .83 – .91			–.18 (1.01)	–4.27 2.13
Positive attitude toward literacy (PATL)	6-item instrument measures students' enjoyment of literacy activities and expressing ideas in writing. Cronbach's α = .71			–.16 (1.03)	–3.11 2.05
Student Background Characteristics					
Precollege ACT (or SAT equivalent) score (ACT)	Composite ACT or SAT equivalent score converted to an ACT metric (information provided by the institution)	–.17 (1.03)	–3.07 2.03	–.17 (1.04)	–3.10 2.06
Male	1 = male, 0 = female	.44	0 1	.45	0 1
Student of color	1 = student of color, 0 = white	.25	0 1	.23	0 1
Parental education	1 = at least one parent has a graduate degree (Masters degree or higher), 0 = neither parent has a graduate degree	.42	0 1	.43	0 1
High school social/academic involvement	7-item composite measures one's degree of involvement in social and academic activities. Cronbach's α = .60	–.07 (1.03)	–3.72 2.40	–.07 (1.02)	–3.65 2.40
Precollege academic motivation	8-item composite measures student motivation for academic pursuits. Cronbach's α = .73	–.11 (1.04)	–3.47 2.60	–.13 (1.01)	–3.43 2.57
College Experience Measures					
Participated in 2007 assessment	1 = participated, 0 = did not participate	.82	0 1	.85	0 1
Attended a liberal arts college	1 = attended a liberal arts college, 0 = attended a regional institution or research university	.24	0 1	.24	0 1

(*Continued*)

TABLE 1 *(Continued)*

Operational Definitions of Variables with Weighted Descriptive Statistics[ab]

Variable	Operational Definition	CT Analytic Sample Mean (*SD*)	CT Analytic Sample Min. Max.	NCS and PATL Analytic Sample Mean (*SD*)	NCS and PATL Analytic Sample Min. Max.
Social sciences/humanities major	1 = social sciences/humanities major, 0 = all other majors	.46	0 1	.48	0 1
Science, technology, engineering or math major	1 = science, technology, engineering or math major 0 = all other majors	.26	0 1	.26	0 1
Worked on a research project with a faculty member (FacRsrch)	1 = worked with a faculty member on research project 0 = did not work with a faculty member on research	.26	0 1	.28	0 1
High quality interactions with faculty (FacInt)	23-item composite scale that combined items on students' perceptions from four highly related subscales: 1. Overall exposure to clear and organized instruction; 2. Faculty interest in teaching and student development; 3. Prompt feedback; and 4. Quality and impact of non-classroom interactions with faculty. Cronbach's α = .92	–.29 (1.06)	–4.33 2.03	–.28 (1.03)	–4.83 1.98
Academic challenge and high expectations (Challenge)	31-item composite scale that combined items from four highly related subscales: 1. Student perceptions of their own academic effort; 2. Challenging classes and high faculty expectations; 3. Frequency of higher-order exams and assignments; and 4. Integration of ideas. Cronbach's α = .88	–.27 (1)	–3.12 2.45	–.23 (.98)	–3.58 2.47
Cocurricular involvement and positive peer interaction (Involvement)	9-item composite scale that jointly measured degree of student involvement in cocurricular activities and the degree to which students reported positive interactions with peers. Cronbach's α = .85	–.14 (1.01)	–5.22 1.77	–.11 (.99)	–5.21 1.76
Frequency of interacting with faculty/student affairs staff (FreqInteract)	9-item composite scale based on student self-reports that combined items from two subscales: 1. Frequency of interactions with faculty; and 2. Frequency of interactions with student affairs staff. Cronbach's α = .83	–.20 (.98)	–2.09 2.89	–.19 (.97)	–2.12 2.94
Cooperative learning experiences (CoopLrng)	4-item composite scale measured student self-reports of the frequency of cooperative learning with peers. Cronbach's α = .70	–.06 (.98)	–2.69 2.10	–.03 (.98)	–2.72 2.14
Interactional diversity (Diversity)	9-item composite scale based on student self-reports from two subscales: 1. Diversity experiences; and 2. Meaningful discussions with diverse peers. Cronbach's α = .80	–.14 (.98)	–2.48 2.90	–.11 (.96)	–2.49 2.95

[a]Variables standardized for the purpose of analysis were done prior to employing the analytic weight.

[b]Constituent items for all scales are available from the WNSLAE Methods section at: http://www.education.uiowa.edu/docs/default-source/crue-publications/research_methods_draft_march2008.pdf?sfvrsn=2

[c]At Time 3.

[d]Dependent variables were measured in spring 2010 with a parallel pretest measured in fall 2006.

[e]Abbreviated variable name used in subsequent tables are presented in parentheses.

gregated the entire sample into thirds and reran the analysis separately on each subsample. All cross-product terms were standardized to reduce collinearity (Jaccard & Turrisi, 2002).

All analyses are based on weighted sample estimates, adjusted to the actual sample size for correct standard errors. Although we would have preferred to statistically control for the nesting of students within institutions, our regression models were detailed and had more variables than individual sampling units (i.e., 17 institutions). We therefore could not employ statistical procedures to adjust the standard errors for the nesting or clustering effect in our data (Raudenbush & Bryk, 2002). Consequently, we used a more stringent alpha level ($p < .01$) for statistical significance to reduce the probability of making a Type I error—falsely rejecting the null hypotheses. However, given the substantially smaller subgroup sample sizes, we employed a more liberal level of significance ($p < .05$) for the subgroup analyses.

Prior to our analyses, all continuous variables were standardized with a mean of 0 and a standard deviation of 1 to permit comparison of otherwise incommensurable explanatory variables (Fox, 2008). For continuous variables, the coefficients represent that part of a standard deviation change in the dependent measure for every one standard deviation increase in the independent measure, all other influences held constant. For categorical independent variables, the coefficients represent that part of a standard deviation change in the dependent measure for each one unit increase in the independent variables (e.g., difference between female and males). Commonly, one would think of these results as effect sizes: standardized betas for the continuous measures and Cohen's d for the dichotomous measures.

Results

The estimated general and conditional effects of the seven high impact/good practices on 2010 (end-of-fourth-year) critical thinking test (CTT), need for cognition scale (NCS) and positive attitude toward literacy (PATL) scale are summarized in Tables 2–4. As the tables indicate, when all other variables in the regression models were controlled statistically, four of the high impact/good practices had a significant ($p < .01$) positive impact on at least one of the three dependent measures. Net of other influences interactional diversity had significant positive associations with all three outcomes, and was the only high impact/good practice dimension to have a significant positive link with 2010 critical thinking skills. Working with a faculty member on a research project and academic challenge and high expectations each had significant

positive net associations with both 2010 need for cognition and 2010 positive attitude toward literacy. Interestingly, there was a net negative relationship between frequency of interacting with faculty/student affairs staff and the 2010 critical thinking measure. In all cases, the significant general effects of high impact/good practices were modest in magnitude—ranging from about .07 to about .25 of a standard deviation (SD). However, given extensive statistical controls, including both ACT score and a precollege measure of each outcome variable, these estimated effect sizes are consistent with those yielded in the vast majority of longitudinal investigations of college impact (Astin, 1993; Pascarella & Terenzini, 1991, 2005).

Conditional Effects Analyses

We conducted the second stage of the analyses to determine the presence of conditional effects for the high impact/good practice dimensions on the three outcome measures. We found statistically significant increases in the explained variance only for 2010 critical thinking and 2010 positive attitude toward literacy. In the prediction of critical thinking, the sets of cross-product terms for the pretest and sex added separately to the general effects equation were associated with a statistically significant increase in the percent of explained variance. The results showed a positive interaction between students' pretest scores and frequency of interacting with faculty/student affairs staff, moderating the negative general effect interactions with faculty and student affairs staff had on critical thinking scores. This suggests the relationship between the frequency of interacting with faculty and student affairs staff is more negative for students with lower critical thinking scores at the start of college than their peers with higher precollege critical thinking scores. We also found negative interaction effects between students' critical thinking pretest score and interactional diversity as well as having worked with a faculty member on a research project. These results demonstrate the general effects of these high impact/good practices were attenuated for students with higher pretest critical thinking scores. Finally, in terms of the block of cross-product terms between sex and high impact/good practices, the conditional effects analysis showed a positive interaction effect between male and high quality interactions with faculty on critical thinking although no main effect relationship between high quality interactions with faculty and critical thinking were identified.

In the prediction of positive attitude toward literacy, all but the race set of cross-product terms were associated with statistically significant increases in explained variance. In terms of the cross-products for the

TABLE 2
Estimated Effects of High Impact/Good Practices on 2010 Critical Thinking (n = 998)[a]

	General Effects Model		Conditional Effects Model with Pretest		Conditional Effects Model with Sex	
Predictor	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Pretest (Fall 2006)	.487	16.1**	.511	15.62**	.491	16.30**
Male	.005	.11	.015	.35	–.006	–.12
Student of color	–.028	–.52	–.007	–.13	–.022	–.40
ACT	.304	9.86**	.302	9.83**	.307	9.98**
Challenge	.017	.59	.018	.59	.034	.88
Diversity	.083	3.08*	.076	2.84	.111	3.27**
FreqInteract	–.102	–3.74**	–.104	–3.74**	–.159	–4.65**
FacInt	.044	1.77	.034	1.31	–.013	–.40
Involvement	.008	.34	.014	.61	.038	1.33
CoopLrng	.014	.56	.004	.15	–.018	–.54
FacRsrch	.087	1.75	.114	2.27	.004	.07
R^2 total (F(18, 979) = 88.50**)	.619					
Cross-product models						
Pretest*FacInt			–.022	–.94		
Pretest*CoopLrng			–.017	–.79		
Pretest*FacInt			–.022	–.94		
Pretest*CoopLrng			–.017	–.79		
Pretest*FreqInt			.067	2.78*		
Pretest*Challenge			.010	.35		
Pretest*Diversity			–.082	–3.05*		
Pretest*Involvement			–.033	–1.48		
Pretest*FacRsrch			–.129	–2.72*		
R^2 total (F(25, 972) = 66.21**)			.630			
R^2change (F(7, 972) = 4.00**)						
Male*FacInt					.139	2.80*
Male*CoopLrng					.081	1.75
Male*FreqInt					.124	2.42
Male*Challenge					–.049	–.87
Male*Diversity					–.083	–1.59
Male*Involvement					–.087	–1.87
Male*FacRsrch					.195	1.99
R^2 total (F(25, 972) = 66.28**)					.630	
R^2change (F(7, 972) = 4.09**)						

[a]All models include controls for precollege academic motivation, high school social/academic involvement, parental graduate education, participation in the 2007 assessment, attendance at a liberal arts college, majored in social sciences or humanities, and majored in science, engineering, technology or math field.
*p < .01. **p < .001.

TABLE 3

Estimated Effects of High Impact/Good Practices on Spring 2010 Need for Cognition (n = 2063)[ab]

	General Effects Model	
Predictor	Coefficient	t-ratio
Pretest (Fall 2006)	.457	22.24**
Male	.187	5.38**
Student of color	–.186	–4.27**
ACT	.098	5.14**
Challenge	.247	10.63**
Diversity	.074	3.34**
FreqInt	.024	1.12
FacInt	.048	2.38
Involvement	.026	1.41
CoopLrng	–.033	–1.69
FacRsrch	.138	3.47**
R^2 total (F(18, 2044) = 100.97**)	.471	

[a]All models include controls for precollege academic motivation, high school social/academic involvement, parental graduate education, participation in the 2007 assessment, attendance at a liberal arts college, majored in social sciences or humanities, and majored in science, engineering, technology or math field.

[b]None of the cross-product blocks significantly increased the explained variance in the dependent measure. Thus, we present coefficients only for the general effects model.

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

TABLE 4
Estimated Effects of High Impact/Good Practices on 2010 Positive Attitude Toward Literacy ($n = 2067$)[a]

	General Effects Model		Conditional Effects Model with Pretest		Conditional Effects Model with Sex		Conditional Effects Model with ACT	
Predictor	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Pretest (Fall 2006)	.518	26.27**	.569	24.05**	.523	26.49**	.518	26.25**
Male	–.041	–1.13	–.047	–1.31	–.111	–2.48	–.381	–1.05
Student of color	.023	.53	.030	.68	.025	.55	.025	.56
ACT	.051	2.63*	.051	2.65*	.054	2.78*	.082	3.56*
Challenge	.148	6.17**	.144	5.85**	.156	4.86**	.147	6.04**
Diversity	.142	6.16**	.114	4.88**	.094	3.14*	.132	5.67**
FreqInt	–.020	–.91	.001	.05	.008	.29	–.028	–1.24
FacInt	.023	1.08	.035	1.67	.029	1.10	.037	1.67
Involvement	.001	.03	.004	.18	.026	1.05	–.005	–0.25
CoopLrng	–.045	–2.26	–.052	–2.55	–.027	–.99	–.056	–2.74*
FacRsrch	.121	2.95*	.114	2.80*	.045	.86	.124	3.02*
R^2 total ($F(18, 2048) = 95.38$**)	.456							
Cross-product models								
Pretest*FacInt			.054	2.94*				
Pretest*CoopLrng			–.020	–1.16				
Pretest*FreqInt			.083	3.91**				
Pretest*Challenge			–.030	–1.32				
Pretest*Diversity			–.10	–5.14**				
Pretest*Involvement			.009	.48				
Pretest*FacRsrch			–.146	–3.87**				
R^2 total ($F(25, 2041) = 72.90$**)			.472					
R^2 change ($F(7, 2041) = 8.68$**)								

(Continued)

[a]All models include controls for precollege academic motivation, high school social/academic involvement, parental graduate education, participation in the 2007 assessment, attendance at a liberal arts college, majored in social sciences or humanities, and majored in science, engineering, technology or math field.
*$p < .01$. **$p < .001$.

TABLE 4 *(Continued)*

Estimated Effects of High Impact/Good Practices on 2010 Positive Attitude Toward Literacy ($n = 2067$)[a]

	General Effects Model		Conditional Effects Model with Pretest		Conditional Effects Model with Sex		Conditional Effects Model with ACT	
Predictor	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Cross-product models								
Male*FacInt					–.015	–.36		
Male*CoopLrng					–.043	–1.13		
Male*FreqInt					–.067	–1.56		
Male*Challenge					–.008	–.16		
Male*Diversity					.115	2.62*		
Male*Involvement					–.066	–1.72		
Male*FacRsrch					.187	2.39		
R^2 total ($F(25, 2041) = 69.82$**)					.461			
R^2 change ($F(7, 2041) = 2.69$**)								
ACT*FacInt							.051	2.50
ACT*CoopLrng							–.071	–3.92**
ACT*FreqInt							.005	0.25
ACT*Challenge							.012	0.56
ACT*Diversity							–.044	–2.07
ACT*Involvement							–.14	–0.75
ACT*FacRsrch							–0.63	–1.54
R^2 total ($F(25, 2041) = 70.68$ **)							.464	
R^2 change ($F(7, 2041) = 4.36$**)								

[a]All models include controls for precollege academic motivation, high school social/academic involvement, parental graduate education, participation in the 2007 assessment, attendance at a liberal arts college, majored in social sciences or humanities, and majored in science, engineering, technology or math field.

*$p < .01$. **$p < .001$.

pretest, we found two positive interactions between students' pretest scores and high quality interactions with faculty as well as frequency of interactions with faculty and student affairs staff. Neither of these high impact/good practice measures had statistically significant main effects suggesting that the relationship is moderated by students' positive attitude toward literacy pretest scores. Students with higher pretest scores experienced a greater benefit in interacting with faculty and student affairs staff with respect to developing a positive attitude toward literacy. Similar to the negative effects found between pretest and high impact/good practices and critical thinking, we found negative interactions between the positive attitude toward literacy pretest and interactional diversity as well as having worked with a faculty member on a research project. This suggests that the positive main effect between these high impact/good practices is reduced for students with higher pretest scores.

The statistically significant set of cross-product terms for sex and high impact/good practices was the result of the significantly positive interaction between male and interactional diversity, with the positive general effect being experienced more profoundly by men. Finally, the block of cross-product terms between ACT (or SAT equivalent) and high impact/good practices was statistically significant due to the significant negative interaction term between ACT and cooperative learning experiences on positive attitude toward literacy. Although cooperative learning experiences did not have a statistically significant main effect with 2010 positive attitude toward literacy, as students' ACT scores increased, we found a negative relationship between engaging in cooperative learning experiences and students' positive attitude toward literacy.

Given that the inclusion of the various blocks of cross-product terms increased the proportion of explained variance for critical thinking and positive attitude toward literacy, we disaggregated the sample to examine the relationships between the high impact/good practices and the two outcomes for those subgroups where the set of cross-product terms was statistically significant ($p < .01$). To determine the nature of the conditional effects, we followed the suggestion of Cronbach and Snow (1977) and reran the general effects equations for different sample subgroups on the precollege variables involved (i.e., ACT score, 2006 CTT or PATL score, and sex). We present the subgroup results for the statistically significant interaction terms in Table 5.

TABLE 5

Conditional Effects of High Impact/Good Practices on 2010 Critical Thinking (CT) and Positive Attitude Toward Literacy (PATL)

Dependent Variable/Conditional Effect	Coefficient (t-ratio)
2010 CT	
Diversity × Precollege Critical Thinking (PCT)	
Diversity coefficient for lowest third PCT	.152 (2.49*)
Diversity coefficient for middle third PCT	.105 (1.95)
Diversity coefficient for highest third PCT	.001 (0.05)
FacRsrch × PCT	
FacRsrch coefficient for lowest third PCT	.351 (2.85**)
FacRsrch coefficient for middle third PCT	–.134 (–1.25)
FacRsrch coefficient for highest third PCT	.064 (1.45)
FreqInt x PCT	
FreqInt coefficient for lowest third PCT	–.159 (–2.75**)
FreqInt coefficient for middle third PCT	–.126 (–2.30*)
FreqInt coefficient for highest third PCT	–.058* (–2.04)
FacInt × Sex	
FacInt coefficient for men	.140 (3.38***)
FacInt coefficient for women	–.015 (–0.49)
Diversity × Race (See Note at bottom of Table)	

TABLE 5 *(Continued)*

Conditional Effects of High Impact/Good Practices on 2010 Critical Thinking (CT) and Positive Attitude Toward Literacy (PATL)

Dependent Variable/Conditional Effect	Coefficient (t-ratio)
2010 PATL	
Diversity × Precollege Positive Attitude Toward Literacy (PPATL)	
Diversity coefficient for lowest third PPATL	.194 (4.97***)
Diversity coefficient for middle third PPATL	.100 (2.67**)
Diversity coefficient for highest third PPATL	.078 (1.81)
FacRsrch × PPATL	
FacRsrch coefficient for lowest third PPATL	.304 (3.91***)
FacRsrch coefficient for middle third PPATL	.113 (1.77)
FacRsrch coefficient for highest third PPATL	–.059 (–0.85)
FacInt × PPATL	
FacInt coefficient for lowest third PPATL	.022 (.61)
FacInt coefficient for middle third PPATL	–.005 (–0.15)
FacInt coefficient for highest third PPATL	.074 (1.90)
FreqInt × PPATL	
FreqInt coefficient for lowest third PPATL	–.075 (–1.85)
FreqInt coefficient for middle third PPATL	–.005 (–0.15)
FreqInt coefficient for highest third PPATL	.029 (.67)
Diversity × Sex	
Diversity coefficient for men	.216 (5.99***)
Diversity coefficient for women	.092 (3.06**)
CoopLrn × Precollege ACT Score (PACT)	
CoopLrn coefficient for lowest third PACT	.085 (2.40*)
CoopLrn coefficient for middle third PACT	–.131 (–3.86***)
CoopLrn coefficient for highest third PACT	–.094 (–2.71**)

Note. In an earlier paper (Seifert et al., 2012), we reported the effects of interactional diversity and cocurricular involvement were significantly moderated by race. Specifically, interactional diversity enhanced critical thinking growth for white students, but not for students of color, while cocurricular involvement fostered gains in critical thinking for students of color but, not for their white counterparts. These significant conditional effects were based on a somewhat smaller sample than the present study. In the present analyses, the corresponding conditional effects were in the same direction as those previously reported and marginally significant. The effect of interactional diversity experiences on critical thinking was –.044 ($p > .10$) for students of color, and .088 ($p < .01$) for White students. The effect of co-curricular involvement and positive interactions with peers on critical thinking was .097 ($p < .05$) for students of color, and –.008 ($p > .10$) for their White peers.

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

Disaggregated Subgroup Analyses

The interaction effects for critical thinking and positive attitude toward literacy were further differentiated in the subgroup analyses. It is important to recall, however, that disaggregating the sample by subgroups reduces the sample size and thus, we employed a $p < .05$ level of significance at this stage. As shown in Table 5, the magnitude of the influence on critical thinking of the high impact/good practice dimensions was significantly moderated by a student's precollege (fall 2006) critical thinking score and sex. When we divided the sample into thirds based on precollege critical thinking score, the effect of interactional diversity on 2010 critical thinking was strongest for the lowest third of the distribution with decreasingly weaker magnitudes for the middle and highest third of the pretest distribution. The negative interaction effect between working with a faculty member and critical thinking pretest yielded similar disaggregated findings. The relationship between working with a faculty member and 2010 critical thinking was positive with the strongest magnitude and statistically significant only for those students in the lowest third of the precollege critical thinking distribution. However, net of other high impact/good practices, the frequency of interacting with faculty and student affairs staff had a progressively more negative relationship with critical thinking at lower levels of the precollege critical thinking distribution.

The effects of high quality interactions with faculty on 2010 critical thinking were statistically significant for men and essentially trivial for women. Finally, although the cross-product block for race and the high impact/good practices was not significant at our specified level of significance ($p < .01$), they were in the same direction as the significant conditional effects reported in an earlier version of our analyses based on a smaller sample (Seifert et al., 2012). Interactional diversity had a significant positive influence on critical thinking for White students, but not for students of color. Conversely, cocurricular involvement and positive interactions with peers was related to 2010 critical thinking for students of color but not for White students (see Note at bottom of Table 5).

The differentiating magnitude of the high impact/good practice effects was also evidenced in the positive attitude toward literacy subgroup analyses. As with the prediction of 2010 critical thinking, the magnitude of the effects of both interactional diversity and working with a faculty member on a research project was moderated by a student's precollege positive attitude toward literacy score. In both instances, the high impact/good practice dimension had its strongest posi-

tive effect on 2010 positive attitude toward literacy for students in the lowest third of the precollege distribution. As pretest scores increased, the impact on 2010 positive attitude toward literacy of both high impact/good practice dimensions tended to decrease in magnitude. Although we found positive interaction effects between precollege positive attitude toward literacy and high quality interactions with faculty and frequency of interacting with faculty and student affairs staff in the second stage of the analyses, none of the coefficients were statistically significant in the 2010 positive attitude toward literacy subgroup analyses but trended in the expected positive direction.

The effect of interactional diversity on 2010 positive attitude toward literacy was positive and statistically significant for both men and women. However, the effect for men was more than two times as large as the effect for women. Finally, in terms of the subgroup analyses for ACT score, the negative interaction effect from stage two yielded substantial subgroup differentiation. Students in the lowest third of precollege ACT scores benefitted the most from cooperative learning experiences while there was a negative relationship between experiencing cooperative learning environments and 2010 positive attitude toward literacy for students in the top two thirds of the ACT distribution.

Discussion

Recent inquiry on student engagement and good practices in undergraduate education (Cruce et al., 2006; Kuh et al., 2008) has suggested the developmental influence of high impact experiences and exposure to good practices in college may be moderated by the individual characteristics and traits students bring to postsecondary study. In other words, the relationships between high impact/good practices and learning outcomes may not be uniform for all students (general effect), but vary in magnitude, and perhaps even direction, for different kinds of students (conditional effect). This study explored this premise by estimating the general and conditional effects of seven high impact/good practices on dimensions of effective reasoning (critical thinking skills) and inclination to inquire and lifelong learning (need for cognition and positive attitude toward literacy) over four years of college. We discuss our findings in terms of how more methodologically complex approaches to college impact research yield more nuanced and substantive findings to guide policy, practice, theory development and future research.

Consistent with previous research (Arum & Roksa, 2011; Pascarella, Blaich, Martin, & Hanson, 2011), the cognitive skills and orientations toward inquiry and continued learning students bring with them at col-

lege entry are the most powerful predictors of their skills and orientations at the end of their fourth year, suggesting the postsecondary environment and the experiences that occur within this milieu are less influential in contributing to student learning. That said, our results indicated several high impact/good practices, net of students' background characteristics, were positively associated with students' end-of-fourth year critical thinking, need for cognition, and positive attitude toward literacy. In the first stage of our analyses, we found significant positive, albeit modest, general effects for at least one high impact/good practice dimension on all three end-of-fourth-year outcomes. Interactional diversity had a significant general effect on all three outcomes while working with a faculty member on a research project and academic challenge and high expectations positively influenced need for cognition and positive attitude toward literacy. Although experiencing high impact/good practices generally yielded positive relationships with the outcomes, net of all other high impact/good practice measures and holding constant other influences, the frequency of interacting with faculty and student affairs staff had a negative relationship with fourth year critical thinking.

More importantly, however, for two of the three fourth-year outcomes—critical thinking skills and positive attitude toward literacy—the general effects identified in the first stage of our analyses tended to be misleading. In some cases significant general effects masked substantial underlying differences in the magnitude of the effect for different student subgroups. For example, interactional diversity appeared to have a significant general effect on both critical thinking and positive attitude toward literacy. Yet, examination of the significant conditional effects indicated that the positive influence of interactional diversity on both outcomes tended to be compensatory. That is, the greatest benefits from engagement in interactional diversity experiences accrued to students who entered college in 2006 with relatively lower levels of both critical thinking skills and positive attitude toward literacy than their peers.

There were also instances of nonsignificant general effects that masked significant effects of high impact/good practices for particular subgroups of students. For example, net of other factors working with a faculty member on a research project failed to have a significant general effect on fourth-year critical thinking skills. However, for students who entered postsecondary education with critical thinking skills in the lowest third of the distribution, working with a faculty member on a research project conferred a substantial and statistically significant advantage in fourth-year critical thinking skills. Similarly, we found no

statistically significant relationship between cooperative learning experiences and fourth year positive attitude toward literacy in our general effects model but this masked a statistically significant negative interaction effect between cooperative learning experiences and precollege ACT score on the outcome.

Overall, our findings strongly suggest student background characteristics and the precollege effective reasoning and problem solving and precollege inclinations to inquire and lifelong learning that students bring to postsecondary education may substantially moderate the benefits students derive from exposure to, or engagement in, high impact/good practices. Thus, investigations that fail to probe beyond estimating general effects may mask the influence of such high impact/good practices for specific student subgroups. Put another way, while high impact/good practices appear to count significantly in explaining fourth-year critical thinking, need for cognition and positive attitude toward literacy, the relationship between high impact/good practices and these outcomes are complex and depend to a substantial degree on the characteristics of the students having the experience. High impact/good practices may not constitute a broadly applicable "silver bullet" for effective undergraduate education.

Absent a programmatic panacea, higher education scholars and practitioners must adapt theoretical and conceptual models of college impact to account for the ways students with different background characteristics engage with the college environment. Our findings suggest research that treats incoming first-year students as "blank slates" risks overestimation of the effects of the good practices. Indeed, future conceptualizations of high impact/good practices that do not investigate the potential conditional effects between student background characteristics and experience of good practice on student learning outcomes risk not only inaccuracy but may also miss important findings.

Beyond the benefits that methodological complexity provide to theory generation, more nuanced findings offer opportunities to better tailor and customize programs to meet the unique needs of different student subgroups. Although we found a host of conditional effects between various student background characteristics and experiences of high impact/good practices, two—interactional diversity and working with a faculty member on a research project—tended to have a compensatory influence on both end of fourth-year critical thinking skills and positive attitude toward literacy. That is, the greatest benefits of engagement in each experience accrued to students who began college at the relatively lowest levels of either 2006 critical thinking or 2006 positive attitude toward literacy. Such evidence is consistent with previ-

ous research (Cruce et al., 2006; Kuh et al., 2008; Loes, Pascarella & Umbach, 2012).

It is important to point out that compensatory conditional effects are quite distinguishable from effects due to regression toward the mean. The latter effect is manifest in those who start out lowest on a measure making the greatest gains on the measure over time. However, compensatory conditional effects in this study indicate that students who enter college lowest on either critical thinking skills or positive attitude toward literacy derive the greatest benefits from engaging in interactional diversity and working with a faculty member on a research project. What we have termed a "compensatory effect" may also be one of greater learning efficiency for those students with better precollege preparation. In this regard, experiencing good practices (likely those experienced in high school which provided these students with better precollege preparation) perpetuates efficient learning, thus the high impact/good practices have negligible and nonstatistically significant relationships with the outcomes. However, we suggest for those students who are less prepared for college (and who may have experienced high impact/good practices in high school less often), experiencing these in the college classroom kick starts their learning and compensates for their lack of precollege preparation.

Although the benefits of interactional diversity and working with a faculty member on a research project were not of the same magnitude across all student subgroups, neither high impact/good practice had a statistically reliable negative relationship for any student subgroup on any outcome. The same can be said for the subgroup analyses by sex examining the effect of high quality interactions with faculty on critical thinking and interactional diversity on positive attitude toward literacy. In both cases, men benefitted more from this high impact/good practice exposure but not at their female peers' expense.

For the most part, these compensatory effects did not result to the detriment of others. However, there were two circumstances where the subgroup analyses pointed to statistically significant negative relationships between high impact/good practices and outcomes. The relationship between frequency of interacting with faculty and student affairs staff and critical thinking was experienced most negatively for students with the lowest third precollege critical thinking scores. Additionally, students in the lowest third of the precollege ACT distribution positively benefitted from cooperative learning experiences while their peers in the middle and highest third of the distribution experienced a negative relationship between cooperative learning experiences and their fourth-year positive attitude toward literacy.

Findings regarding the compensatory effects of interactional diversity, working with a faculty member on a research project, and meaningfully interacting with faculty provide the higher education community with an opportunity to improve the learning environment for specific student subgroups while not impinging on the learning environment and experiences of other groups. Yet with many opportunities come commensurate challenges. These opportunities are complimented by the challenge to address the negative relationships between frequency of interacting with faculty and student affairs staff and cooperative learning experienced negatively by some student subgroups. This level of nuance to the findings presents educators with information to focus institutional efforts in support of both the opportunities and the challenges.

In general, our findings point to opportunities to create positive learning environments in which high quality relationships are fostered, expectations are articulated clearly, and diverse perspectives are valued. In creating such environments, faculty and student affairs staff must recognize their role in facilitating undergraduate student learning. Faculty and staff can signal their investment by taking advantage of on-campus professional development opportunities. For student affairs staff, professional development may take the form of viewing one's work as an educator and service provider (Keeling, 2008). This may be a beneficial reorientation in addressing the negative relationship between frequency of interacting with faculty and student affairs staff and critical thinking which is most negative for students with the lowest precollege critical thinking scores. Given the positive benefits of high quality interactions with faculty for men and working with a faculty member on research projects for students at the lowest end of the pretest distributions, faculty development workshops that support faculty in reaching out to students who may not naturally seek relationships with faculty members appear to be a good starting place. Faculty development focused on structuring peer learning experiences such that students recognize and value their role as learners and teachers (see Newton & Ender, 2010) may address the negative interaction effect of cooperative learning experiences on positive attitude toward literacy. Irrespective of the form professional development takes, we find the differentiated findings in the present study suggest the need for educators to reconsider their practice, programs and policies in an effort to optimize student learning.

With regard to interactional diversity, institutions may create a wide variety of structured opportunities and incentive structures to encourage faculty, staff and student participation. Structured opportunities to engage in interactional diversity experiences range from cross-cultural and intergroup dialogue programs to facilitated in-class discussion to

residence hall programming. In each case, institutions face challenges to ensure the experiences are both meaningful and genuine but excellent models exist to support and facilitate institutional commitment to these experiences (see Patel & Meyer, 2011; Schoem & Hurtado, 2001). More fundamentally, however, institutions must recognize student diversity, in all its forms, is an obvious prerequisite to interactional diversity experiences.

Faculty members are encouraged to work with undergraduate students on research projects (see the National Science Foundation's (2012) Research Experiences for Undergraduates program) but we posit that most students invited to engage in research with a faculty member are the best and the brightest, and unlikely to be the students at the lower-third of the critical thinking distribution at college matriculation. Given our findings suggest the greatest benefits are realized by those students who are the least likely to be invited to be part of a research team, Centers of Teaching and Learning may seize this opportunity to educate faculty in the process of creating, training, supervising and mentoring diverse research teams.

The principles behind a diverse research team—where students (postdoctoral, graduate and upper year undergraduate) help other students to learn and contribute to a faculty research project—could be transposed to the cooperative learning realm. The negative relationship between cooperative learning and positive attitude toward literacy for students in the middle and highest thirds of the precollege ACT distribution may be due to students not viewing group work as a legitimate pedagogy in which their interest in learning can be enhanced. However, if faculty members are provided with professional development opportunities to develop their comfort and confidence in crafting cooperative learning experiences where group work is grounded in the notion of teaching and learning reciprocity, students at the middle and upper end of the distribution may see that they have as much to gain as to give.

Synthesizing the implications from this study, we have articulated both methodological and programmatic considerations—both connected to the goals of critical quantitative research (Stage, 2007). Our findings suggest the necessity of examining conditional effects as a matter of course in college impact research. Failing to test for conditional effects runs the risk of masking the relationship between student background characteristics and how students experience and engage in college, thus misestimating the relationship between high impact/good practices and measures of student learning. To the extent that higher education institutions use empirical evidence to inform policy, practice and pedagogy, the research community must be committed to questioning and

testing the efficacy of conceptual models of college impact across student groups. Indeed, if our institutions are to live up to their potential in developing and supporting equitable educational opportunities for all students, our understanding of student learning and development must become more nuanced, with educators using this knowledge to modify and tailor programs, practices, and policies accordingly.

Notes

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[1] Constituent items for each composite measure can be accessed from: http://www.education.uiowa.edu/docs/default-source/crue publications/research_methods_draft_march2008.pdf?sfvrsn=2

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