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Is More Always Better? The Curvilinear Relationships between College Student Experiences and Outcomes

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Abstract Many higher education studies have examined linear relationships between student experiences and outcomes, but this assumption may be questionable. In two notable examples previous research that assumed a linear relationship reached different substantive conclusions and implications than did research that explored non-linear associations among the same constructs. Indeed, many relationships between college experiences and outcomes may actually be curvilinear; this study explored that possibility within a large, multi-institutional, longitudinal dataset. As expected, most of the significant positive relationships were accompanied by significant curvilinear associations, such that the magnitude of the relationship decreased with higher levels of involvement.

Keywords College students · Curvilinear relationships · College experiences · Student outcomes

The body of research literature on college student experiences and outcomes is voluminous (Feldman & Newcomb, 1969; Mayhew et al., 2016; Pascarella & Terenzini, 1991, 2005). Many of these studies have examined the frequency of participation in various forms of student engagement, which is indicated by either the number of hours per week or relatively

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vague response options (e.g., ranging from "never" to "very often"). Researchers often claim that the presence of a significant, positive relationship between engagement and a desired outcome indicates that this experience should probably be promoted, while a negative relationship suggests that it should be reduced or avoided. No relationship means that there may not be a meaningful association.

However, these studies may violate an often overlooked assumption: that the relationship between a predictor and outcome is linear (Cohen, Cohen, West, & Aiken, 2003; Pedhazur, 1997; Tabachnick & Fidell, 2013). The examination of non-linear relationships is still fairly rare, which could lead to incorrect conclusions about the potential effect of various university experiences. We discuss below two instances in which curvilinear relationships clearly exist; in doing so we provide theory that supports the presence of such effects and discuss the flawed implications that would result from studies that (improperly) assume linearity. Next, we argue that many relationships between student experiences and growth may be curvilinear in nature. By "curvilinear," we mean that the relationship between an experience and outcome is non-linear or does not fit on a straight line; for example, increases in student engagement might be positively related to desired outcomes at low levels of engagement, but then this association decreases or disappears at high levels of engagement. This non-liner nature of the relationship, then, may take the form of a "U-shaped" curve (i.e., curvilinear), rather than a straight line. We examine this possibility using a large, longitudinal sample of undergraduates.

This project has important implications, especially given that funding for higher education is becoming increasingly scarce in many countries. Colleges and universities have a limited amount of resources that they can invest to help improve the student experience. Having accurate information about the effects of these experiences—and when some students could potentially experience too much of an otherwise good thing—can help higher education practitioners and administrators target their efforts more effectively. Working during college constitutes one salient example.

Paid Employment and Student Attrition

The link between working for pay and subsequent student retention, persistence, and graduation has been explored in dozens of studies in the past 15 years. The vast majority of research that examines the linear relationship between hours spent working and attrition finds no significant association, with occasional findings of significant positive or negative relationships (for reviews, see Mayhew et al., 2016; Perna, 2010). These studies often analyzed nationally representative datasets and included appropriate control variables, so the rigor of these findings seems quite strong. From this literature alone, any reasonable observer would conclude that there is no relationship between paid employment and student attrition.

However, these conclusions differ notably from research that examined involvement using specific cutoffs for the number of hours worked per week. Studies of full-time employment have all found that a high level of occupational engagement is associated with a lower likelihood of retention, persistence, and graduation (Martinez, Sher, Krull, & Wood, 2009; Sibulkin & Butler, 2005; Somers, Woodhouse, & Cofer, 2004). Other research used different categories for the amount of time spent working; students in the highest category exhibited lower attainment than those who did not work at all, regardless of whether this cutoff was at 35 hours per week (Raley, Kim, & Daniels, 2012; Roksa, 2011), 30 hours (Attewell, Heil, & Reisel, 2011), or 20 hours (Bozick, 2007; Titus, 2006a, b). Importantly, across all of these studies, students who worked

modest amounts (1–10 hours and sometimes 11–20 hours per week) were not more likely to drop out than those who did not work; and they were sometimes even more likely to stay in school than their non-working counterparts (Martinez et al., 2009; Roksa, 2011).

The implications for practice and policy differ remarkably depending on whether linear or non-linear relationships are considered. The findings for the first set of studies suggests that working for pay is not an obstacle to degree completion, so institutions should not be concerned with how much their students work. Grants and scholarships may also be viewed as less important: Students could simply work more hours to help pay for more of their education because paid employment appears to have no adverse effect on persistence and completion. In contrast, findings that consider non-linear relationships would suggest that working modest amounts may not be detrimental, but working extensively is quite problematic.

This curvilinear pattern of results is consistent with student departure theories that emphasize the importance of involvement, adjustment, and integration (e.g., Braxton, Hirschy, & McClendon, 2004; Cabrera, Nora, & Castañeda, 1992; Museus, 2014; Tinto, 1993). High involvement with paid employment likely detracts from participation in other activities that would foster college adjustment. Modest levels of campus employment may be one way to help promote college integration and therefore reduce attrition; indeed, this form of engagement is sometimes positively related to retention and graduation (Adelman, 2005; Herzog, 2005).

Diversity Experiences and Student Growth

Research that explores the linear association between diversity experiences and outcomes frequently identifies significant relationships; this literature is so voluminous that it has been synthesized through several quantitative meta-analyses. Intergroup interactions are inversely associated with prejudice among college students (Pettigrew & Tropp, 2006), and students' intergroup friendships are positively related to intergroup attitudes (Davies, Tropp, Aron, Pettigrew, & Wright, 2011). Moreover, students' experiences with interpersonal, curricular, and co-curricular diversity are all positively associated with cognitive outcomes (Bowman, 2010a) and civic engagement (Bowman, 2011). Other meta-analyses that focus on curricular and co-curricular diversity also find negative associations with racial bias (Denson, 2009; Engberg, 2004) although many of these studies used binary indicators of diversity participation.

However, the presence of consistently significant results does not imply that these relationships are linear. Relevant theoretical frameworks propose that initial diversity experiences often result in dissonance and disequilibrium as people struggle to reconcile their personal experiences with their previously held beliefs and worldviews (Crisp & Turner, 2011; Gurin, Dey, Hurtado, & Gurin, 2002). As a result, repeated exposure to diversity—and the dissonance resolution process that can result from such experiences—may be necessary to realize desired outcomes (Crisp & Turner, 2011). Indeed, frequent or very frequent intergroup interactions are associated with increases in several outcomes (Bowman, 2013); taking multiple diversity courses predicts gains in psychological well-being and favorable orientations toward diversity (Bowman, 2010b, 2010c), and high levels of curricular and co-curricular diversity engagement predict improvements in intergroup attitudes and civic engagement (Denson & Bowman, 2013). In contrast, having rare interpersonal interactions across difference, taking a single diversity course and engaging in moderate levels of curricular/co-curricular diversity are not related to increases; this modest diversity engagement often predicts slightly worse outcomes than not having any diversity experiences (Bowman, 2010a, b, 2013). Bowman (2013) also demonstrated the presence of a significant, curvilinear

relationship between interpersonal diversity interactions and several outcomes. Thus, the positive relationships in most research may be driven by the substantial gains realized by students who have high levels of engagement.

Once again, the implications for practice and policy differ notably depending upon whether curvilinear relationships are examined. When solely considering evidence from studies of linear relationships, any increase in diversity engagement is associated with student growth, so colleges and universities should be satisfied with adding a single diversity course requirement or fostering occasional interactions across difference. Any increases in the diversity of the student body would also be welcomed since the racial heterogeneity of an institution has a positive, linear relationship with the frequency of intergroup interactions (Chang, 1999; Chang, Astin, & Kim, 2004; Park, Denson, & Bowman, 2013; Pike & Kuh, 2006), which may then lead to desired outcomes. However, the curvilinear evidence indicates that minimal diversity experiences are generally insufficient to foster student growth—and they may even be counterproductive if they occur only rarely—so repeated exposure to diversity is necessary. Attempts to promote diversity interactions through a diverse student body need to be substantial since the link between structural racial diversity and interracial friendships is also curvilinear, with a stronger positive link at high levels of diversity (Bowman, 2012; Fischer, 2008).

Curvilinear Relationships between Student Experiences and Growth

When considering how various student experiences might be associated with intended outcomes, the nature of the relationship between diversity and student growth may be more the exception than the rule. Diversity engagement comes with a level of challenge that is arguably greater than for most other experiences with peers, coursework, or student organizations. Instead, college experiences may often provide diminishing returns with higher levels of engagement. According to Astin's (1984) theory of involvement, the amount of psychological and physical energy devoted to a task contributes to learning and development (for a related argument regarding university students' quality of effort, see Pace, 1982). While changes in psychological energy or investment associated with an activity may drive student growth, this energy and corresponding learning opportunities may not be linearly related to the amount of time that students spend. For instance, a student who begins to participate in co-curricular activities for five hours per week (versus not at all) may realize notable gains in psychological investment and learning since this initial foray into campus activities is likely to provide meaningful opportunities for leadership development, socializing, and intellectual growth. This increase is likely much greater than that of someone who is already involved for 25 hours per week and who then invests an extra five hours per week. The learning opportunities provided by these additional activities are probably similar to those that were present within the first 25 hours, and it seems unlikely that this incremental change in involvement is psychologically meaningful.

In this article, we report on a study that investigated the possibility that college experiences will often exhibit non-linear relationships with learning and growth outcomes, such that positive relationships will diminish with greater levels of involvement. We used a multi-institutional, longitudinal dataset with well-established outcome measures to examine changes over time. Because we do not believe that this expected pattern is unique to particular outcomes, we conducted analyses on all of the available primary outcome variables, which range from well-being to critical thinking to leadership skills. To provide a rigorous examination, it was important to use a meaningful response scale for university experiences. As a

result, instead of relying on experiences with response scales in which the level of engagement was unclear (e.g., "rarely" versus "sometimes" or "often"), we only used experiences that were indicated by the number of hours per week and that had equal intervals within each category (1–5, 6–10, 11–15, etc.). We sought and received approval for human subjects research.

The Study and Methods

Data Source and Participants

The source of our data was the Wabash National Study of Liberal Arts Education (WNS), which is a multi-institutional, longitudinal study of the experiences and outcomes of undergraduates. Employing a pretest/posttest design from 2006 to 2012, the WNS focuses on outcomes associated with a liberal arts education, including critical thinking, psychological well-being, moral reasoning, diversity orientation, and leadership. The WNS sample includes a range of institutional types, including varying size, type, mission, selectivity, and geographic location. The analytic sample in this study consisted of the 46 four-year institutions in the dataset.

The WNS contains three cohorts of full-time, first-time students who started their postsecondary education at participating institutions. At the beginning of the fall semester, first-year students completed a WNS precollege survey and a series of outcome assessments. In the following spring, at the end of students' first year, data measuring students' experiences were collected, along with a second set of outcome assessments. Of the 16,719 students who attended a four-year institution and participated in the first wave of the WNS, 8475 completed assessments at the end of the first year, yielding a response rate of 50.7%. A weighting algorithm was used to adjust for potential response bias by sex, race, academic ability, and institution. Among the weighted sample of students, 56.0% were female, 76.9% were White/Caucasian, 10.3% were Black/African American, 5.7% were Asian/Pacific Islander, 4.8% were Hispanic/Latino, and 2.3% reported "other" race/ethnicity.

Measures

The dependent variables of interest in this study included the six primary learning outcomes of the WNS (Center for Research on Undergraduate Education, 2008). Psychological well-being, which was assessed using the Ryff Scales of Psychological Well-Being, reflects a composite of six dimensions of human flourishing (54 items; $\alpha = .89$; Ryff, 1989). Moral reasoning was operationalized as the extent to which people use post-conventional moral schemas through the N2 score of the Defining Issues Test 2 (12 items; $\alpha = .80$; Rest, Narvaez, Thoma, & Bebeau, 1999). Critical thinking skills were measured with the critical thinking module of the Collegiate Assessment of Academic Proficiency (32 items; $\alpha = .81$; ACT, 1991). Need for cognition reflects students' desire and tendency to engage in cognitively challenging activities (18 items; $\alpha = .89$; Cacioppo, Petty, Feinstein, & Jarvis, 1996). Orientations toward diversity, which include cognitive, interpersonal, and intrapersonal components, were measured with the short form of the Miville-Guzman Universality Diversity Scale (15 items; $\alpha = .85$; Fuertes, Miville, Mohr, Sedlacek, & Gretchen, 2000). Finally, leadership skills were indicated by the overall score of the Socially Responsible Leadership Scale (68 items; $\alpha = .93$; Dugan, 2006).

The independent variables of interest for this study were four experience measures of how students spent time during their first year, which were drawn from the WNS administration of the

National Survey of Student Engagement (NSSE). These measures included working for pay, engaging in co-curricular activities, socializing and relaxing, and preparing for class. These variables had response scales that indicated the number of hours spent per week in five-hour increments. Variables were standardized with a mean of zero and a standard deviation of one, and each variable was then squared to create an indicator of the curvilinear relationship. This standardization before computing the curvilinear term allows the linear relationship to be modeled appropriately when the squared term is included in the analysis (Jaccard & Turrisi, 2003). The experiences in this study constitute all variables in the dataset that used this response scale, except for two variables that had very low means and were also unlikely to contribute to student outcomes. These two variables were commuting to school and providing care for dependents.

This study used numerous control variables to account for other factors that may influence the outcomes, including student precollege characteristics, institutional characteristics, and other experiences. Demographics included students' sex (0 = female, 1 = male), race/ethnicity (several dummy variables for Asian/Pacific Islander, Black/African American, Hispanic/Latino, and other race/ethnicity, with White/Caucasian as the referent group), and parental education (binary variable for whether at least one parent has a bachelor's degree). Precollege academic variables included high school GPA (1 = below D-, to 5 = A- to A+), standardized test scores (ACT composite or converted SAT), and academic motivation (8 items; $\alpha = .74$). Importantly, the pretest for each outcome upon entering college was also included.

Key institutional attributes and college experiences were also included. Institutional type was assessed via dummy variables (regional university and research university, with liberal arts institution as the referent group). Institutional selectivity was measured with Barron's selectivity index (1 = noncompetitive, to 6 = most competitive). Undergraduate major was included since this attribute is related to a variety of experiences and outcomes (Pascarella & Terenzini, 2005); dummy-coded categories were arts and humanities, biological science, business, education, engineering, physical science, professional, other, and undecided, with social science serving as the referent group. To facilitate the interpretation of effect sizes, all dependent variables and continuous independent variables were standardized with a mean of zero and a standard deviation of one (Cohen et al., 2003). Descriptive statistics are provided in Table 1.

Analyses

Analyses were performed using ordinary least squares multiple regression. In all models the key predictors were the linear and squared variables for time spent working for pay, engaging in co-curricular activities, socializing and relaxing, and preparing for class. Race/ethnicity, sex, parental education, high school GPA, standardized test scores, precollege academic motivation, pretest for the corresponding outcome measure, institutional type, institutional selectivity, and undergraduate major served as control variables. Further, to account for the fact that students were members of a particular WNS cohort, all analyses included two dummy variables to control for cohort membership. Preliminary analyses showed that including the squared terms in the models did not affect the substantive results for the linear relationship between student experiences and outcomes. All variables in all models had variance inflation factors (VIFs) under 3.0; moreover, with only one exception (for standardized test scores predicting critical thinking), all VIFs were under 2.5. To control for potential issues related to nesting of students within institutions in the WNS, all analyses utilized a Stata clustering command (svy).

Table 1 Descriptive statistics for all variables

	Mean	SD	Range
Male	.44	.50	.00–1.00
Asian/Pacific Islander	.06	.23	.00–1.00
Black/African American	.10	.30	.00–1.00
Hispanic/Latino/a	.05	.21	.00–1.00
Other Race/Ethnicity	.02	.15	.00–1.00
Parental Education	.47	.50	.00–1.00
High School GPA	.00	1.00	-6.30 – .78
Standardized Test Score	.00	1.00	-3.73 – 2.24
Precollege Academic Motivation	.00	1.00	-4.68 – 2.50
Regional University Attendance	.30	.46	.00–1.00
Research University Attendance	.40	.49	.00–1.00
Barron's Selectivity	.00	1.00	-1.70 – 1.77
Arts or Humanities Major	.13	.34	.00–1.00
Biological Science Major	.10	.30	.00–1.00
Business Major	.14	.35	.00–1.00
Education Major	.07	.25	.00–1.00
Engineering Major	.06	.23	.00–1.00
Physical Science Major	.04	.21	.00–1.00
Professional Major	.13	.34	.00–1.00
Other Major	.14	.35	.00–1.00
Undecided Major	.04	.20	.00–1.00
Hours Worked for Pay	.00	1.00	-.75–3.70
Hours Participating in Co-curricular Activities	.00	1.00	-1.03 – 3.40
Hours Spent Socializing and Relaxing	.00	1.00	-1.81 – 2.37
Hours Spent Preparing for Class	.00	1.00	-2.09 – 2.12
Hours Worked for Pay (Squared)	.00	1.00	.01–13.65
Hours Participating in Co-curricular Activities (Squared)	.00	1.00	.06–11.56
Hours Spent Socializing and Relaxing (Squared)	.00	1.00	.00–5.64
Hours Spent Preparing for Class (Squared)	.00	1.00	.08–4.47
Beginning of First-Year Psychological Well-Being	.00	1.00	-4.89 – 2.52
Beginning of First-Year Critical Thinking	.00	1.00	-2.94 – 1.95
Beginning of First-Year Moral Reasoning	.00	1.00	-2.83 – 2.98
Beginning of First-Year Need for Cognition	.00	1.00	-3.83 – 2.52
Beginning of First-Year Diversity Orientation	.00	1.00	-5.51 – 2.16
Beginning of First-Year Leadership Skills	.00	1.00	-6.50 – 2.33
End of First-Year Psychological Well-Being	.00	1.00	-4.77 – 2.38
End of First-Year Critical Thinking	.00	1.00	-2.62 – 1.71
End of First-Year Moral Reasoning	.00	1.00	-2.88 – 2.63
End of First-Year Need for Cognition	.00	1.00	-3.96 – 2.47
End of First-Year Diversity Orientation	.00	1.00	-5.27 – 2.13
End of First-Year Leadership Skills	.00	1.00	-5.77 – 2.16

Limitations

Some limitations in this study should be noted. First, the variables used by the researchers were limited to those available within the WNS dataset. We included all primary outcomes and experiences with appropriate response scales in the dataset in order to achieve the best possible understanding of the associations between various experiences and outcomes, but it is unclear whether the results may have differed for other experiences and outcomes. Second, the WNS includes a variety of institutional types, but these institutions are not necessarily representative of all U.S. institutions. As a result, it is unclear to what extent the study's findings generalize beyond this sample. However, there is no particular reason to believe that the potential for diminishing returns of student experiences would be unique to these particular institutions.

Results

Results for all student experience variables and outcomes are provided in Table 2. For most of the instances in which a significant linear relationship is present, a significant curvilinear relationship is also present, as indicated by the result for the corresponding squared term. The significance of both the linear and curvilinear terms in each model suggests that the frequently assumed linear relationship between each college experience and outcome may not accurately reflect the true relationship between these constructs. In those instances the significance of a squared term for the college experience suggests that the relationship may, in fact, be curvilinear, wherby the relationship diminishes as students invest more time in the experience.

The linear and curvilinear relationships across all outcomes are most prevalent for two of the student experiences: time spent in co-curricular activities and preparing for class. Specifically, significant, positive linear relationships exist for co-curricular activities predicting psychological well-being and leadership skills; in both cases these are attenuated by significant negative curvilinear patterns. When considered in combination, these findings mean that co-curricular activities are positively related to desired outcomes overall, but this association diminishes—and actually becomes negative—at high levels of engagement. This same pairing of positive linear and negative curvilinear results also occurs for time spent preparing for class predicting psychological well-being and moral reasoning (both coefficients for moral reasoning are only marginally significant). To illustrate this pattern Fig. 1 provides a graph of the relationship between co-curricular activities and leadership skills. The overall positive association levels off and actually becomes negative around 1 ½ standard deviations above the mean.

Table 2 Unstandardized regression coefficients for the relationship between time spent on college experiences and college outcomes

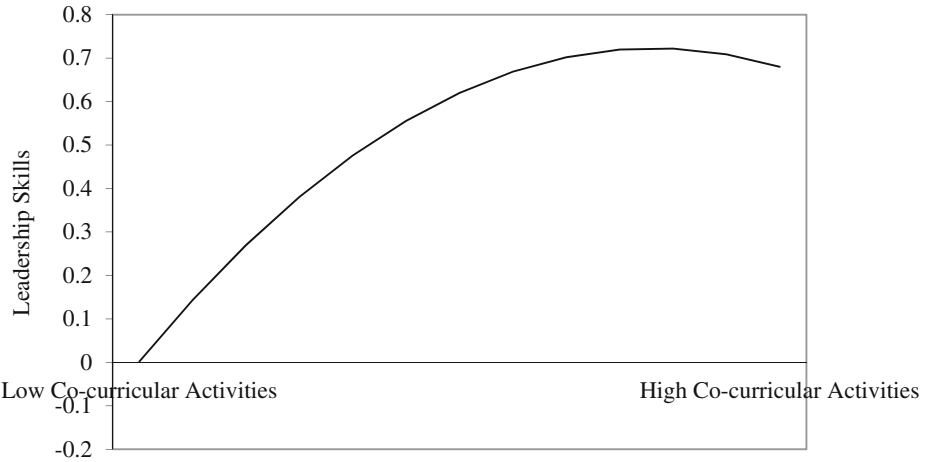
College Experience	Psychological Well-Being	Critical Thinking	Moral Reasoning	Need for Cognition	Diversity Orientation	Leadership Skills
Hours Participating in Co-curricular Activities	.06**	−.10***	.00	.04	.02	.11***
	(.02)	(.03)	(.02)	(.03)	(.02)	(.02)
Hours Participating in Co-curricular Activities (Squared)	−.03*	.03**	−.01	−.02*	−.01	−.03**
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Hours Spent Preparing for Class	.06***	.02	.06^	−.07***	.02	.05*
	(.02)	(.01)	(.03)	(.01)	(.02)	(.02)
Hours Spent Preparing for Class (Squared)	−.03*	.00	−.03^	.01	.00	.00
	(.01)	(.01)	(.02)	(.01)	(.01)	(.02)
Hours Worked for Pay	.00	−.01	−.05	−.02	−.01	−.01
	(.02)	(.02)	(.03)	(.01)	(.02)	(.03)
Hours Worked for Pay (Squared)	.00	.00	.02	.01	.01	.02
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Hours Spent Socializing and Relaxing	.00	.02	.02	−.03**	.00	.01
	(.02)	(.02)	(.02)	(.01)	(.02)	(.02)
Hours Spent Socializing and Relaxing (Squared)	.01	−.01	−.02	.00	−.01	.01
	(.01)	(.01)	(.01)	(.01)	(.01)	(.02)
R^2	.47	.64	.58	.55	.49	.32

Standard errors are in parentheses. Control variables included sex, race/ethnicity, parental education, high school grades, standardized test scores, precollege academic motivation, institutional type, institutional selectivity, college major, and a precollege measure of each of the outcomes examined. All dependent variables and continuous independent variables were standardized with a mean of zero and a standard deviation of one for inclusion in the analyses. ^$p < .10$ *$p < .05$ **$p < .01$ ***$p < .001$

Two other pairs of findings also exhibit attenuation patterns. First, the linear relationship between co-curricular activity and need for cognition is positive, albeit nonsignificant; it also has a significant negative curvilinear coefficient. Thus, the general pattern of a positive relationship that decreases at higher levels of engagement still holds. Second, co-curricular activities and critical thinking show a mirror image of this attenuation pattern since it has a significant negative linear relationship and a significant positive curvilinear relationship. That is, co-curricular activities are negatively related to critical thinking; but this association diminishes (i.e., becomes less negative or closer to zero) at higher levels of engagement. However, not all findings exhibit attenuation patterns. Time spent preparing for class has a positive linear relationship with leadership skills and a negative linear relationship with need for cognition, but no corresponding curvilinear associations are significant. Moreover, only one coefficient for time working for pay and for socializing and relaxing is significant in any linear or curvilinear relationship; specifically, socializing is a negative, linear predictor of need for cognition.

Discussion

In this article, we explore the extent to which the associations between student experiences and outcomes do not fit the assumption of linearity. As expected, most of the significant linear relationships observed in this study are accompanied by significant curvilinear relationships, suggesting that the linear relationship may not accurately reflect the true nature of the association. In all instances, these relationships become smaller in magnitude (i.e., closer to zero) and ultimately reverse direction with greater levels of engagement. This non-linear pattern occurs for the substantial majority of positive linear associations, which supports the argument that college experiences may have diminishing returns for promoting student



Note. The lowest point of the graph was set zero to make the relationship easier to interpret. The scale for the dependent variable is in standard deviation units. The horizontal endpoints of the graph are two standard deviations above and below the mean for co-curricular activities.

Fig. 1 Curvilinear relationship between co-curricular activities and leadership skills

growth. The consistency of these findings suggests that many previous studies may have overlooked such non-linear relationships when exploring a broad array of research questions.

Two of the three of the instances in which significant linear relationships do not have corresponding curvilinear relationships occurred for negative main effects. Given that the argument for curvilinearity rests on diminishing positive returns for physical investment and the presence of learning opportunities, this rationale does not seem particularly applicable to negative relationships, such as time spent socializing and relaxing predicting decreases in need for cognition. It is interesting that the significant negative linear relationship for hours spent participating in co-curricular activities predicting critical thinking is modified by a significant positive curvilinear relationship, which is not explained by this framework. Accounting for the negative linear association is also difficult; but other research has also yielded the same finding for this experience and outcome (Trolian, An, & Pascarella, 2016), which suggests that this result is not the product of the particular control variables or other features of this study.

The curvilinear findings in this study occur exclusively for co-curricular activities and preparing for class, whereas no such significant findings are apparent for time spent working or spent socializing and relaxing. None of the 12 linear relationships for working for pay and for socializing/relaxing is positive and significant, and only one is negative and significant; so these differential patterns may simply be attributable to the fact that there are no positive relationships that could diminish with greater levels of engagement. Across all experiences, significant curvilinear associations occur for five of the six dependent variables, which include indicators of psychological well-being; cognition (skills, tendencies, and development); and leadership, which is a composite of interpersonal and intrapersonal attributes. Thus, these non-linear results appear to be generalizable across a range of desired student outcomes.

For each of the curvilinear findings, the relationship between the experience and outcome reaches zero about 1–2 standard deviations above the mean (as shown in Fig. 1). The phrase "diminishing returns" may therefore be a misnomer because the positive relationships cease to exist—and actually become negative—at high levels of engagement. The inverse associations may occur because students are engaging extensively in these pursuits at the expense of other meaningful and useful experiences, which may be related to the curriculum, co-curriculum, interpersonal interactions, or simply getting enough sleep. Certainly, students may gain something important by extensive participation in co-curricular activities (e.g., meaningful leadership experience) or extensive time spent preparing for class (e.g., a high college GPA and subsequent graduate school admittance), so the negative relationships for these particular outcomes do not imply that this substantial engagement serves no useful function. Nonetheless, having particularly extensive experiences in one domain may not be as educationally beneficial as becoming involved in new pursuits and/or tempering one's involvement.

Implications

The findings from this study have important implications for research and practice. From a research and assessment perspective, assuming linearity may often lead to incorrect conclusions about the association between experiences and outcomes. As described earlier, results may erroneously suggest that an experience is unrelated to student outcomes when it may actually be detrimental with high involvement (as with working for pay and student attrition), or it may suggest experiences have unequivocally positive results when they may actually lead to poorer outcomes when done infrequently (as with diversity experiences and student

growth). Our study found diminishing relationships for engaging in co-curricular activities and preparing for class, but the curvilinear associations for these experiences may differ from those of various other forms of interpersonal and academic engagement. Further inquiry is needed not only to establish the generalizability of these results, but also to appropriately examine any form of engagement that occurs upon a frequency or intensity continuum.

Non-linear relationships can be modeled statistically in multiple ways. This study standardized the original scale and included a squared curvilinear term because this approach allowed us to determine simultaneously whether significant linear and curvilinear relationships exist. As another approach, researchers can create several dummy variables that indicate different levels of involvement, as indicated by the number of hours per week or another metric. If no involvement serves as the referent group, then each coefficient represents whether students with that level of involvement differ on the outcome(s) of interest than those who are not involved (supplementary analyses showed that this approach also indicates curvilinear relationships within the present dataset). This strategy has worked well for studying employment because this construct is easily conceptualized in terms of number of hours per week, the findings for a specific number of hours have meaningful real-world implications (e.g., for determining how much work-study support to provide), and institutions might consider students who exceed a certain threshold to be at risk for attrition and allocate resources accordingly.

Because the positive relationships of engagement taper off at high levels, practitioners may choose to provide more students with involvement opportunities rather than focusing efforts on students who are highly involved. Given the limited resources available today at many institutions, decisions about how employees spend their time and which programs are initiated are even more critical (e.g., starting an intensive multi-year leadership program versus broadening access to internship opportunities). The current findings suggest that promoting widespread engagement among students who are less involved may often be more educationally beneficial than promoting extensive engagement among students who are already active.

Conclusion

This study provides a significant contribution by demonstrating that the actual nature of the relationship between student experiences and outcomes merits more nuanced attention since these significant associations are often non-linear. Although our study focused specifically on students, the presence of non-linear relationships may certainly extend to other topics within and outside of higher education, which should also be considered. Exploring these dynamics in future research is critical for providing a more complete understanding of the complex interplay between predictors and desired outcomes.

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