Who Receives a Liberal Education?
Measuring Breadth and Depth of Study at U.S. Colleges

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Introduction

For centuries, liberal education has been viewed in the U.S. as an ideal format for preparing students for life, work, and citizenship (Rothblatt, 2003). According to common notions, *liberally-educated* college graduates are those who think critically, communicate effectively, consider divergent perspectives, and work towards the common good. Leading voices in American higher education argue that providing people with more exposure to liberal education is key to solving serious social problems, including political polarization, rampant disinformation, and ascendant authoritarian leadership (Carnevale et al., 2020; Lawrence & Pasquerella, 2020).

Despite liberal education's stated importance, little empirical evidence exists about the scope of students' exposure to this type of education. This lack of evidence is partly due to the fact that liberal education as a construct—what it is, how it is delivered—is evolving and contested (Kimball, 1986; Rothblatt, 2003). However, one way of providing liberal education has become prominent over the past century that uses breadth of study across the liberal arts and depth of study in a major as key mechanisms for its delivery (Delbanco, 2012). For example, the American Association of Colleges and Universities (AAC&U) contends that liberal learning outcomes are produced, in part, by learning widely about human culture and society and the natural and physical world, while higher-order competencies are developed by increasingly advanced applications within a problem area (2011). Students do this by taking courses in the sciences and mathematics (i.e., the *natural sciences*), *social sciences*, and *humanities*, which include the study of history, languages, and the arts (AAC&U, 2011).

However, just because institutions say they provide a broad and deep education does not mean that all students are equally likely to receive it. There are forces working against curricular breadth in particular, including the trend towards increased disciplinary specialization (National Academies, 2018). Some evidence suggests that low-SES students, concerned about career prospects, avoid liberal arts subjects in the humanities and social sciences for fear they won't lead directly to employment (Goyette & Mullen, 2006; Heller, 2023). As a result of these trends, students are less likely to major in a liberal arts field now than they were a decade ago (Paulson et al., 2024). When there are fewer liberal arts majors, logic suggests departments will reduce liberal arts course offerings (Harris, 2018).

Given liberal education's potential ability to produce beneficial social outcomes, it is crucial to measure students' exposure to this form of education. In this study, we examine the degree to which students at a range of public four-year institutions in the U.S. receive a major component of liberal education by quantifying the curricular breadth and depth of their course-taking across their entire degree pathways. We examine differences in breadth and depth across students' fields of study and demographic backgrounds. To situate these analyses, we first provide a brief description of how breadth and depth became defining features of liberal education in the United States.

Framework

Origins of Depth and Breadth

The roots of American liberal education can be traced to the Cambridge and Oxford model, brought to the colonies in the 17th century to train young men "of high social standing" at

institutions such as Harvard and Princeton for public leadership (Kimball, 2010; McCaughey, 2019). The colonial college curriculum was, by modern conceptions, narrow. It focused on teaching what was then the liberal arts—Latin, Greek, philosophy, logic, and religion—and was highly prescribed. Over the next two centuries, the curriculum expanded to include science and math due to the influence of the Enlightenment. Nevertheless, the curriculum retained its focus on teaching the knowledge believed important for a 'learned person' to know to engage in effective civic leadership (McCaughey, 2019). Opportunities to become a learned person largely remained limited to those in positions of power—white, male, and high-SES.

Two developments in the 19th century had a profound impact on how liberal education is currently practiced in the U.S.. The first occurred when Harvard College revamped its prescribed curriculum into an elective system, which allowed undergraduates to choose the courses they wished to take (McCaughey, 2019). The second was the birth of research universities, which expanded the mission of institutions from merely transmitting knowledge to creating new knowledge; this led to disciplinary expansion and specialization (Kimball, 1986; McCaughey, 2019). Notably, university faculty branched into the academic study of society—leading to a distinguishable set of disciplines known as the social sciences. By the early 20th century, the liberal arts were broadly considered to be subjects of 'disinterested inquiry' (i.e., those not directed towards learning a particular profession) in the humanities, natural sciences, and social sciences (McCaughey, 2019).

The expansion of the disciplines and introduction of an elective curriculum resulted in great debates about what a college education should entail (Kimball, 1986, 2010). On one side were proponents of returning to a prescribed and common curriculum. They argued that to be

liberally-educated, students needed to be exposed to the 'common heritage of educated citizens', mostly classical subjects and notable thinkers from western Europe (Orill, 1997).[1] On the other side were proponents of curricular flexibility that held that all disciplines were of merit for developing the 'habits of mind' that should be the hallmark of liberal education (Bennet, 1997; Orill, 1997).

A middle ground was reached in the early 20th century when Harvard instituted a *distribution system* to put structure around undergraduate curricular choices while allowing for student agency. The system required students to take about a third of their courses across the humanities, social sciences, and natural sciences, about a third of courses deeply studying in one discipline (the specialization), and the remaining courses in whichever subjects they wished (Melia, 1995). This required combination of depth and breadth, Harvard's president at the time argued, would ensure "the best type of liberal education in our complex modern world," for it would produce "men who know a little of everything and something well" (Lowell, as cited in Melia, 1995, p.262). This distribution-based model for ensuring breadth and depth of study across the liberal arts diffused to other institutions focused on undergraduate education (Robinson, 2011).

The Inclusive Model of Liberal Education

[1] Flavors of the 'common heritage model' are still practiced., although much less so than the model of wide and deep learning in use at most institutions today (Delbanco, 2012; Rothblatt, 2003). St. John's College is perhaps the most well-known. The common heritage model has also been invoked with an overtly political and American orientation during recent efforts to revamp the New College of Florida's curriculum and develop civic literacy centers.

As the 20th century progressed, a more inclusive conception of liberal education emerged, one that encompassed students who were not seeking liberal arts degrees at universities or attending liberal arts colleges. For example, organizations such as AAC&U and other leaders now argue that all students can and should receive a liberal education marked by extensive breadth, depth, and engagement (AAC&U, 2011, 2020; Gutmann, 2015). Under this conception, liberal education becomes possible for all learners, whether attending a community college or university or majoring in a liberal art or a professional field, as long as breadth of study, the development of intellectual skills, and an integrative approach to learning are imbued in the curriculum. In addition, high-impact practices such as study abroad and living communities provide opportunities for active inquiry (AAC&U, 2011, 2020).

Inclusive liberal education represents an ideal that many institutions strive to provide. In practice, however, the distribution-based model of providing liberal education has become particularly prevalent at large universities for several reasons. First, research-oriented, atomistic faculty are unlikely to collaborate across disciplines in planning a common undergraduate curriculum, making a distribution-based model the default for undergraduate curricular organization (Delbanco, 2012). Further, high-impact practices associated with inclusive liberal education—such as extramural interaction with faculty and participation in study abroad—are optional and unevenly accessible to students (AAC&U, 2016; Kilgo et al., 2015). Curricular breadth and depth, which are required of all students, often become the only components of liberal education that students are guaranteed to receive.

Mechanisms of Depth and Breadth

Almost all U.S. colleges and universities require undergraduates to take courses across liberal arts and related subjects (i.e., *general education*) and within a major to earn a degree (Delbanco, 2012; Lattuca & Stark, 2009). Majors usually follow a sequence in which students gain progressively more depth of knowledge as they progress through their programs, culminating in advanced courses in the field of study (Lattuca & Stark, 2009). This ensures at least a minimum amount of curricular breadth and depth. However, variation and latitude lie within these broad constraints. Programs may differ in the degree to which they scaffold course taking and which courses satisfy general education and degree requirements (Lattuca & Stark, 2009). Because principles of choice are deeply embedded in the American undergraduate experience, students in the same major may choose among a suite of courses that satisfy a given requirement (Chaturapruek et al., 2021; Baker & Huntington-Klein, 2025), and electives allow students to take courses in any subject (Lattuca & Stark, 2009). The numerous mechanisms by which structure and agency influence student course taking suggest that curricular breadth and depth are important elements of a college education to measure.

Prior Research & Contribution

In the handful of studies that measure breadth of study, the primary approach has been to define it in relation to courses taken outside of the student's major, by the number of different departments reflected on a student's transcript, or in relation to the course taking behavior of other students (Goldhaber et al., 2015; Orona et al., 2023; Paulson, 2022; Seah et al., 2020). While these methods are useful for understanding the variety of subjects students learn, they are not closely aligned with the definition of breadth as learning across the liberal arts domains presented above.

In their study of the impact of single- or double-majoring on students' exposure to domains of knowledge, Pitt et al. (2017) come closest to measuring breadth as it is conceptualized by inclusive liberal education proponents. They operationalize breadth with a concentration measure: the sum of squares of the shares of courses taken by a student across nine knowledge domains. They find that breadth of learning across the liberal arts is lowest for physical sciences and engineering majors and highest for social science, humanities, and business majors. The fact that breadth of study does not always cleave along the liberal arts-professional studies dichotomy, as many would expect it to, is intriguing. However, their analysis was conducted on only 240 transcripts submitted to a single graduate school, limiting our ability to extrapolate from these results.

A student's course-taking depth has been measured by the number of courses taken in the major or related majors (Orona et al., 2023; Seah et al., 2020), with senior projects (Rossman et al., 2020), whether the student takes courses similar to one another (Paulson, 2022), and whether the courses have strong ties (Goldhaber et al., 2015). Any of these is a reasonable proxy for depth as it is conceptualized in liberal education. However, some of these measures do not capture whether students' engagement in a field extends to advanced coursework rather than remaining concentrated in introductory or intermediate courses. Additionally, not all students have the opportunity to deepen their studies through senior projects and capstones, although few would consider these students' educations to be totally devoid of depth.

Contribution of the Study

Our analysis makes several contributions to the study of undergraduate education. First, our operationalization of liberal education through the curricular depth and breadth experienced by students at a range of institutions and majors aligns with inclusive definitions of liberal education. Prior quantitative work on the topic has often measured a liberal education with attendance at a liberal arts college or the pursuit of a liberal arts major (Carnevale, Cheah, & van der Werf, 2020; Pascarella et al., 2013), but these categorizations do not capture the experiences of the majority of college students. While we recognize that there is more to the practice of liberal education than breadth and depth, the fact remains that these two components are the main conduit by which many institutions—especially large universities—try to expose students to an education that prepares them for life as educated citizens (Lattuca & Stark, 2009). Thus, our approach represents an important step towards conducting large-scale, empirical evaluations of liberal education's impact and value. Further, our methods can be replicated by other researchers using student transcript data that is widely available through institutional research offices and statewide longitudinal data systems.

Second, quantifying the extent to which students from different social backgrounds are exposed to a liberal education helps deepen our understanding of inequalities in postsecondary education. Despite some improvements, inequalities by race/ethnicity, gender, and socioeconomic background persist in college access, student experiences, and degree attainment (Hamilton et al., 2024; Roksa et al., 2022; Voss et al., 2024). More research is needed on how social reproductive processes shape educational attainment along students' degree pathways (Hamilton et al., 2024; Roksa et al., 2022).

Data and Methodology

Data and Sample

Our analysis uses administrative and transcript data collected as part of the College and Beyond II (CBII) study (Courant et al., 2022). CBII includes data on more than a million bachelor's degree-seeking undergraduates who attended college between 2000 and 2021 in the U.S. at 19 public four-year institutions within seven postsecondary systems (Bell et al., 2022).[2] For more information about the data and why it is ideal for our purposes, see the Appendix. To ensure that we observe students' complete transcripts, we restrict our sample to bachelor's recipients who were freshman entrants and graduated within eight years. Focusing on bachelor's recipients allows us to compare students who plausibly could have taken a similar number of courses when constructing our breadth and depth measures; we exclude transfer students because data limitations prevent us from accurately accounting for transferred credits. In addition, we exclude students from one system due to its substantial missing data on course titles, which are required for classifying course content. This leaves us with a sample size of 287,454 graduates.

The CBII administrative records include information about students' demographics, academic preparation, and degree attainment, including students' major and associated Classification of Instructional Programs (CIP) code. The transcript records include the titles of courses and the names of the departments that offer them. Course content is measured with predicted College Course Map (CCM) and CIP codes for the department that provides the

[2] The institutions include the Georgia College and State University, Indiana University, Truman State University, University of California at Irvine, University of Houston, University of Michigan (Ann Arbor), and all the four-year institutions in the City University of New York system.

course.[3] CCM and CIP codes are used by the U.S. Department of Education to characterize the content of college courses and the programs that offer them, respectively, standardized across institutions and over time. They are hierarchical 6-digit codes that follow a similar pattern: the first two digits define a broad discipline (e.g., 14, Engineering), the third and fourth define a subject within that discipline (e.g., 14.08, Civil Engineering), and the fifth and sixth define a topic within that subject (e.g., 14.0803, Structural Engineering). Given that the CCM taxonomy shares the same structural framework as the CIP (Bryan & Simone, 2012), this alignment ensures consistency when we utilize CCM codes to construct measures for identifying course content (breadth) and CIP codes for defining disciplinary focus (depth). A nice feature of CCM codes is that they are assigned based on course titles rather than the department offering the course, so they reflect course content rather than institutional structure. **Table A1** in the Appendix reports our analytical sample's descriptive statistics.

Measures

We construct the following measures for each student in our analytical sample using the CBII transcript data.

Breadth. We measure *curricular breadth* as the number of distinct subjects taken in the humanities, social sciences, and natural sciences across students' entire undergraduate education. Counting distinct subjects ensures that we measure students' exposure to different bodies of knowledge. This measurement aligns with Pitt et al. (2017), as their approach approximates the

[3] CCM codes in the CBII data are assigned to courses using a classification algorithm applied to course titles and subject codes which was trained on NCES transcript data. See Paulson et. al. (2024) for more details on the classification methods and performance.

concept of breadth adopted by current proponents of inclusive liberal education. However, unlike Pitt et al., we use a course count as our outcome because counts are easier to interpret by stakeholders and reflect that student outcomes are produced by accumulating knowledge attained from discrete courses.

To calculate the breadth measure, we sum the number of unique 4-digit CCM codes for courses taken in subject areas within the humanities, social sciences, and natural sciences on a student's transcript. So, for example, the first anthropology course a student takes counts towards breadth (in social sciences), but the second one does not, nor does a course in mechanical engineering (because it is not a liberal arts subject). We then further partition this aggregate breadth measure into the three domains of humanities, social sciences, and natural sciences. We do so to determine if students accumulate most of their breadth by taking subjects within the same disciplinary area or across all three. For example, a student majoring in chemistry (a natural science) who primarily accumulates breadth by taking courses in physics, biology, biochemistry, geology, and astronomy (all natural sciences) would lack knowledge of human cultures and society gained from the humanities and social sciences. Thus, they would not have received a broad education as conceptualized under the inclusive definition of liberal education. We also calculate several alternative measures of breadth, which are discussed in **Appendix Section 1**.

Depth. We measure *curricular depth* as the maximum number of upper-division courses a student takes within the same focal area using 2-digit CIP codes. Given the variety of course numbering systems used by departments across our data, it would be impossible to determine if a course is upper-division using course numbering alone. Therefore, we classify a

course as upper-division if junior and senior students comprise more than 50% of its enrollment, calculate the number of upper-division courses a student has taken under each 2-digit CIP code in their transcript, and take the maximum. This measure is similar in spirit to prior work that has measured depth of study as the number of courses in the major or related majors (Orona et al., 2023; Seah et al., 2020); those with prerequisites (Zemsky, 1989); or by some notion of content similarity (Paulson, 2022; Goldhaber et al., 2015), but more closely matches the definition of depth that we outlined earlier: advanced study in a focal area. Rather than relying on the student's degree CIP code to define their primary discipline, our approach better reflects students' actual academic concentration, as many pursue substantial depth in disciplines related to but not formally declared as their major. We also calculate several alternative measures of depth, which are discussed in the Appendix.

Liberal education index. Finally, we sum the breadth and depth measures for each student to construct a measure of their overall exposure to the curricular component of a liberal education, which we refer to as the *liberal education index* (*LEI).* While breadth and depth are typically negatively correlated, it is possible for course-taking patterns to measure high or low on both dimensions. The LEI allows us to measure this. Courses that do not contribute to the LEI are (1) second, third, fourth, etc., courses taken in a subject outside the student's primary discipline (which do not contribute to breadth) and (2) lower-division courses in a student's primary discipline (which do not contribute to depth). Although we do not force courses to contribute to only one of the LEI components, it is unlikely that the same course would contribute to both components.

Finally, we briefly describe the additional variables we constructed for each student (more details are available in Appendix Section 1). We aggregate students' majors into nine categories following the practice of the American Academy of Arts and Sciences: business & management, education, engineering, fine & performing arts, health, humanities, natural sciences, social sciences, and other.[4] Regarding students' SES, ideally, we would measure it with detailed information about their family income and parents' level of education. However, the income and parental education data provided by institutions cannot be standardized due to inconsistent levels of detail and missing data. Therefore, we measure whether a student comes from a low SES background by identifying whether students were living in a low-income neighborhood when they entered college. Race and ethnicity categories are Asian; Black; Hispanic; Native American, Alaskan, Hawaiian, and Pacific Islander; White; multi-racial or missing; and nonresident (not U.S. citizen or permanent resident). Ideally, these categorizations would be more nuanced, but we are limited by the way race is measured by the institutions that provided data to the CBII study. Sex is a categorical variable that takes two values: male or female. Academic preparation is measured with standardized ACT and SAT scores and a standardized high school GPA.

Methods

Our descriptive analysis quantifies students' exposure to curricular depth and breadth and identifies factors that predict variation in this aspect of liberal education. We begin by reporting the average depth, breadth (overall and components), and LEI by field of study and student demographics. We then report the full distribution of breadth and depth within each major field.

[4] See AAAS's description of categories here: https://www.amacad.org/humanities-indicators/scope-of-humanities

While straightforward, these patterns have not been previously examined for many students across a diverse set of majors and institutions.

Next, to be able to attribute differences in liberal education exposure to individual factors, we estimate multivariate OLS regression models controlling for multiple factors simultaneously. We regress the breadth and depth measures separately on indicators for students' fields of study, race, sex, and socioeconomic status, as well as potential confounders, as shown in (1),

$$Outcome_{ist} = \beta_0 + \beta_1 Major_i + \beta_2\, Race_i + \beta_3 Female_i + \beta_4 LowInc_i \; + \beta_x X_i + \delta_{st} + \varepsilon_{ist} \quad (1)$$

where $Outcome_{ist}$ represents the curriculum measure (breadth or depth) for student *i* in system *s* in academic year of entry cohort *t*. $Major_i$ is a set of indicators for whether the student graduated with one of eight major fields (humanities is the reference category). $Race_i$, $Female_i$, and $LowInc_i$ are indicators capturing the demographic and SES characteristics of students. X_i is a vector of confounders, including the total number of courses taken, a dummy for whether a student had multiple majors, standardized test scores, number of transferred credits, high school GPA, and dummies indicating whether the standardized test scores, transferred credits, GPA, and SES values have been imputed. In all cases, we include system by cohort fixed effects (δ_{st}) to control for unobserved system-specific time-invariant and time-varying factors, such as institution-specific course-taking requirements or data reporting patterns. Standard errors are clustered by system and entry cohort.

Our primary coefficients of interest are β_1, β_2, β_3, and β_4. These capture the differences in breadth or depth across majors (β_1) that are not explained by student demographics, academic preparation, or institution-cohort-specific factors. Coefficients β_2 to β_4 capture differences in

breadth and depth across demographic groups within fields of study and institutions, while also controlling for student-level factors that may correlate with course-taking. See Appendix Section 1 for a discussion of alternative regression model specifications.

Results

We begin by calculating the curricular breadth and depth for each student in the sample. We find that in the course of earning their degree, students take courses in 14 unique liberal arts subjects (overall breadth) and 13 upper-division courses in their primary discipline (depth), on average. The average LEI (breadth and depth combined) is 27, accounting for a little more than half of the 50 total courses students take. **Figure 1** shows the mean number of courses students take that constitute curricular breadth and depth, disaggregated by field of study. **Panel A** shows that students who major in health, engineering, and natural sciences have the highest LEI scores, whereas students who major in the fine and performing arts, humanities, and "other and unknown" fields have the lowest. Fields also differ substantially in the extent to which students' liberal education comes from breadth *or* depth. Health majors have approximately equal exposure to breadth and depth, whereas engineers obtain much more depth than breadth. Students in the social and natural sciences have the highest level of breadth, while engineering and fine and performing arts have the least.

Though differing in their aggregate exposure to the curriculum of a liberal education, engineering majors and arts majors are similar in that their educational experiences are characterized by much more depth than breadth. When we disaggregate students' breadth and depth by demographics (see **Figures A1-A3** in the Appendix), we find that there is little descriptive variation by SES and very small differences by sex (females have more breadth,

males have more depth). Regarding race/ethnicity, Asian and Black students have the highest levels of combined breadth and depth, while White and multi-racial or those missing data on race/ethnicity have the least.

[Figure 1]

Although both breadth and depth are needed to receive a liberal education, breadth is the curricular component that really differentiates a liberal education from other types of education (Brighouse, 2019; Detweiler, 2021; Zemsky, 1989). To what degree is breadth spread across the liberal arts or concentrated in one domain? **Panel B** shows students' breadth in the humanities, natural sciences, and social sciences. Students in the pre-professional majors of health, business, and education are exposed to subjects across all three domains fairly equally. Social science students also have relatively balanced coursework. In contrast, students in natural sciences and humanities achieve breadth largely by taking courses within their domain. For instance, on average, natural science majors take courses in more than eight different natural science subjects, but fewer than three social science subjects. Finally, both engineering and arts majors achieve their relatively meager level of breadth largely through a single domain. Engineering majors tend to take courses in natural science fields, and arts majors take courses in humanities fields. On average, students from engineering and the arts take courses in only two different social science subjects during their entire undergraduate career.

Average curricular differences across fields of study likely reflect structural features such as the specific requirements for each major and the resulting (in)flexibility in the curriculum.[5]

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[5] **Table A5** in the Appendix describes variation in breadth across and within majors in more detail. We report the average number of unique 4-digit CCM subjects taken (the building block for our breadth measure) in each 2-digit

That said, students in all majors have opportunities to generate breadth and depth through the elective curriculum (Dalberg et al., 2024), as approximately one-third of students' coursework occurs outside of their major and general education requirements (Lattuca & Stark, 2009). So, how much variation is there within fields of study in students' exposure to a liberal education?

Figure 2 summarizes differences in exposure to breadth and depth within majors through kernel density plots. While the average differences across majors are apparent—natural sciences and health having high levels of breadth and engineering and the arts having high levels of depth—more striking is the large *within-major variation*. That is, even among engineering majors, there are still many students achieving a high level of breadth or a low level of depth.

[Figure 2]

In **Figure 3**, we plot the coefficients for field of study, race, low-income neighborhood status, and sex from equation (1) with curricular breadth as the outcome when accounting for these factors simultaneously and controlling for other possible confounders. The comparison groups are humanities, White, not coming from a low-income neighborhood, and male, respectively.

Mirroring the descriptive patterns, the regression shows large differences in breadth between fields and only modest differences across demographic groups. The large breadth difference across majors seen in the descriptive analysis is not due to differential sorting by student demographics, background, or other factors. Relative to students in the humanities,

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CCM, separately for high and low breadth students in each major. While this does not pin down the specific structures that drive these patterns, it does illustrate the components of breadth. For instance, high-breadth (Q4) health majors achieve this by taking additional courses in a range of fields outside of health, including physical and biological sciences, psychology, math, communications and social sciences.

students in the professional fields of business, engineering, and especially the arts take a much narrower curriculum, with two to five fewer subjects in the liberal arts.

Differences in breadth across demographic groups tend to be much smaller than differences by field of study, after accounting for other factors. While students from different racial/ethnic backgrounds and sexes have modest differences in breadth in the descriptive results, these differences are even smaller in the regressions. Female, Asian, and Black students take courses in 0.4-0.5 more subjects than male and White students, respectively. This means that differences in breadth by race and sex are largely a function of what students choose to major in. There are no differences in curricular breadth by neighborhood low-income status. The results are broadly similar when we use our alternative measures of breadth.

[Figure 3]

Figure 4 plots the coefficients for field of study, race, low-income neighborhood status, and sex from equation (1) with curricular depth as the outcome. Again, differences by major are more prominent than differences within majors across demographic groups. Students in engineering, business, the arts, education, and health tend to take more upper-division courses in their primary field (about four to five additional courses) than students in the humanities, natural sciences, and social sciences. This represents a substantially greater level of depth, considering that the mean number of upper-division courses taken by students in their primary field is 14.

Regarding demographic differences, Asian, Black, Hispanic, and Native American students have lower levels of depth than White students, but these differences are small in magnitude. Additionally, female students have less depth than male students. Students' neighborhood income status does not contribute to differences in depth. The patterns are broadly

similar when we use our alternative measures of depth, though the differences by field are smaller in magnitude.

[Figure 4]

Discussion & Conclusion

Despite abundant rhetoric promoting the virtues of a liberal education, few attempts to measure it on a large scale exist. Our study provides one approach to systematically measure components of a liberal education using data widely available to other researchers. We find tremendous variation in curricular breadth and depth of study across students at a diverse set of public institutions, with students' major being a primary driver of this variation

Educational policy debates often frame professional fields and the liberal arts as being in opposition (Cohen, 2016), but our results complicate this narrative. Students in pre-professional majors such as health, education, and business tend to have balanced levels of depth and breadth, with the latter spread across all three liberal arts domains. Such breadth embodies the contemporary ideal of liberal education, where students receive wide exposure to knowledge and pedagogies from multiple subjects while simultaneously mastering a topic of study. These pre-professional students are being exposed to a variety of perspectives and skills that likely support their ability to solve complex problems (Orona et al., 2023).

However, we also found that majors in other pre-professional programs—engineering and the arts—have relatively low levels of breadth. This aligns with previous research that has documented a "culture of disregard" for general education courses among engineering students and faculty (Tichavakunda, 2020). Engineering students' limited exposure to social sciences and humanities content is problematic given the macro-ethical challenges engineers confront in their

work (Wetmore, 2012). For art majors, their low career earnings could be due, in part, to having little exposure to courses outside of their major and the humanities (Hemelt et al., 2023).

We also document variation in the amount of curricular breadth and depth across students who major in liberal arts fields. Our measures of domain-specific breadth illustrate the importance of looking at variation in exposure to knowledge across liberal arts domains. Without such disaggregation, natural science students appear to be exposed to a broad curriculum, but with this disaggregation, the picture changes. Such variation in curricular breadth within the liberal arts also illustrates why researchers should not simply measure receipt of a liberal education by major type or institution.

The fact that demographic factors explain little of the variation in depth and breadth suggests that concerns about race, SES background, and gender constraining exposure to the curricular components of a liberal education may not be well-founded, at least once students are already enrolled in college. However, we faced limitations with some of our demographic measures, SES in particular, which we measured using a neighborhood-level proxy. Sensitivity analyses using student-level data, when available, suggest that our measure of neighborhood SES has validity as a measure of coming from a low-income background. However, the fact remains that we were not able to measure students' SES and race/ethnicity with the nuance they deserve. Therefore, our finding of relatively small differences in breadth and depth by demographic backgrounds should be viewed tentatively and investigated further in future work with more detailed measures.

Collectively, our full models leave more than half of the variation in breadth and depth across students unexplained. It is important to reiterate that our analyses largely document

patterns of exposure to curricular breadth and depth rather than probe the specific institutional and individual mechanisms that drive these patterns. Likely institutional climates and policies contribute to the variation in curricular breadth and depth we document. Unfortunately, given that the CBII data does not contain institutional measures, we are unable to examine these potential mechanisms directly. Future research that can delve more deeply into mechanisms should explore this unexplained variation, as there is little research currently available on how students make course-taking decisions for us to extrapolate from (Stevens et al., 2018).

Perhaps most significantly, our work lays the foundation for subsequent analyses of liberal education's impact. As we noted in the introduction to this paper, many in American higher education believe serious social issues can be addressed by providing more college students with a liberal education. Is this belief well-founded? Liberal education is desired by many because they identify it with intellectual and civic excellence, and—not incidentally—due to its association with elite institutions and the opportunities they provide (Keohane, 2001; Schneider, 2003). Given the deep-rooted historical association between liberal education, high-status institutions, and civic leadership in the U.S., it raises the question as to whether people's deeply held faith in the power of liberal education is, at least in part, due to the *halo effect of school prestige*, as reflected in society's tendency to assume that anything associated with elite institutions is automatically good (Rivera, 2011).

Providing evidence about the value of liberal education will require future researchers to measure liberal education in its various forms and contexts, but particularly those forms practiced at the institutions responsible for educating the bulk of students in the U.S.— large public institutions. The inclusive conception of liberal education breaks down the barriers

between “learning for learning’s sake” and “learning for work” and expands the ideal of a liberal education to include all types of postsecondary institutions, including those with robust transfer student populations and non-selective colleges (AAC&U, 2011). However, such institutions and the systems they inhabit have been characterized as facilitating a “patchwork” approach to general education and major course-taking that is not the equivalent of a coherent liberal education (Grubb & Lazerson, 2005). Since liberal education is too amorphous a concept for all people to agree about what it entails, “the ultimate test” of whether an education is liberal, “is not what we teach, but what the students learn and what they become” (Shapiro, 2005, p. 94). Applying measures like ours to future studies will provide much-needed empirical evidence about whether an education marked by extensive breadth and depth of study is associated with the liberal learning outcomes many desire.

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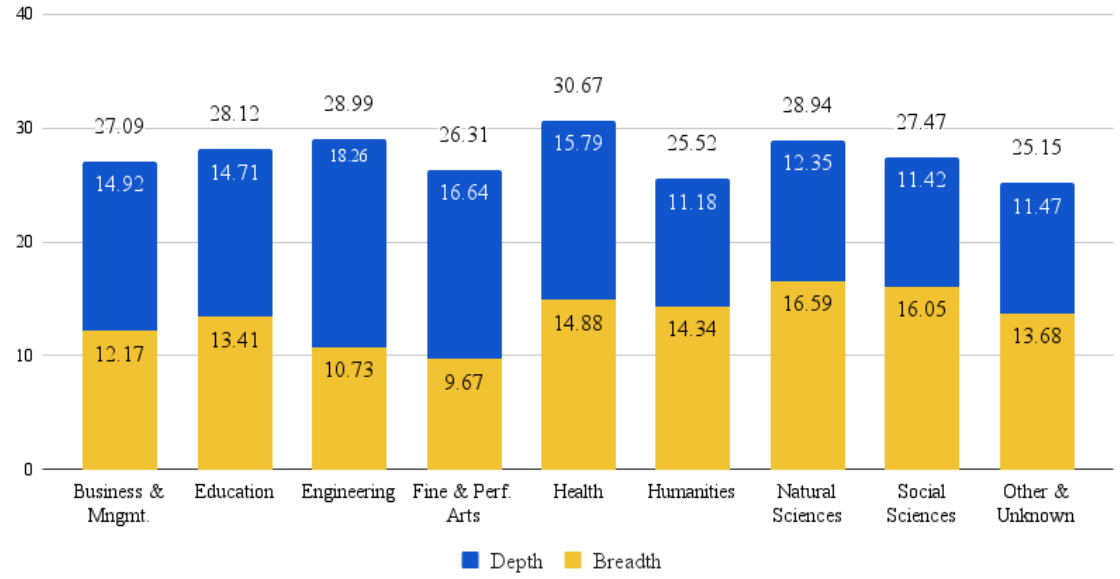
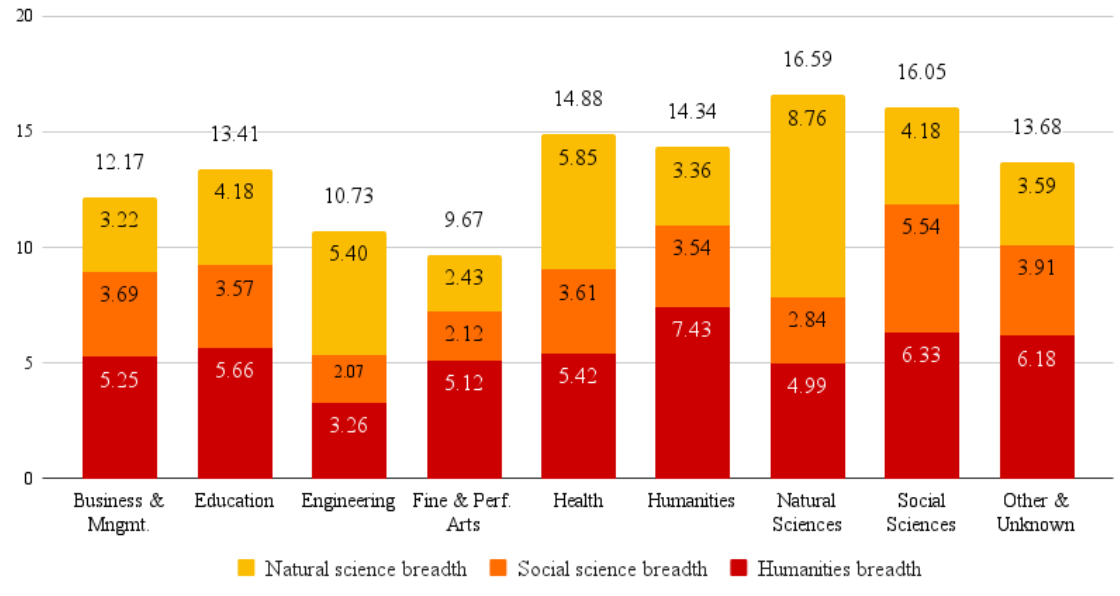
Figures

Figure 1. Number of Undergraduate Courses that Constitute Breadth and Depth, by Fields of Study

A. Depth and Overall Breadth



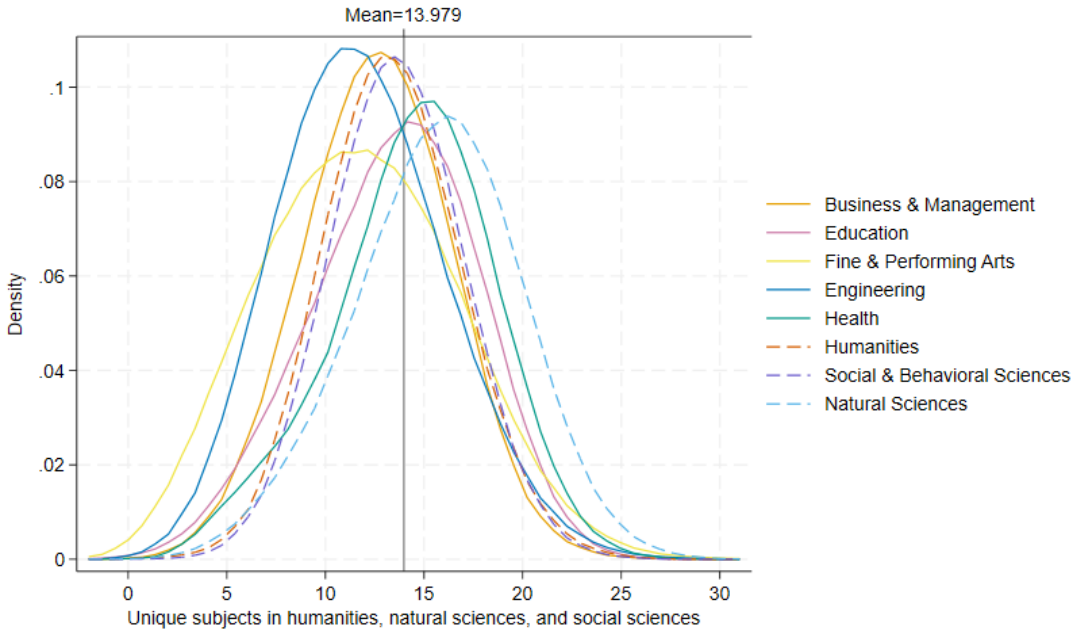
B. Domain-specific Breadth



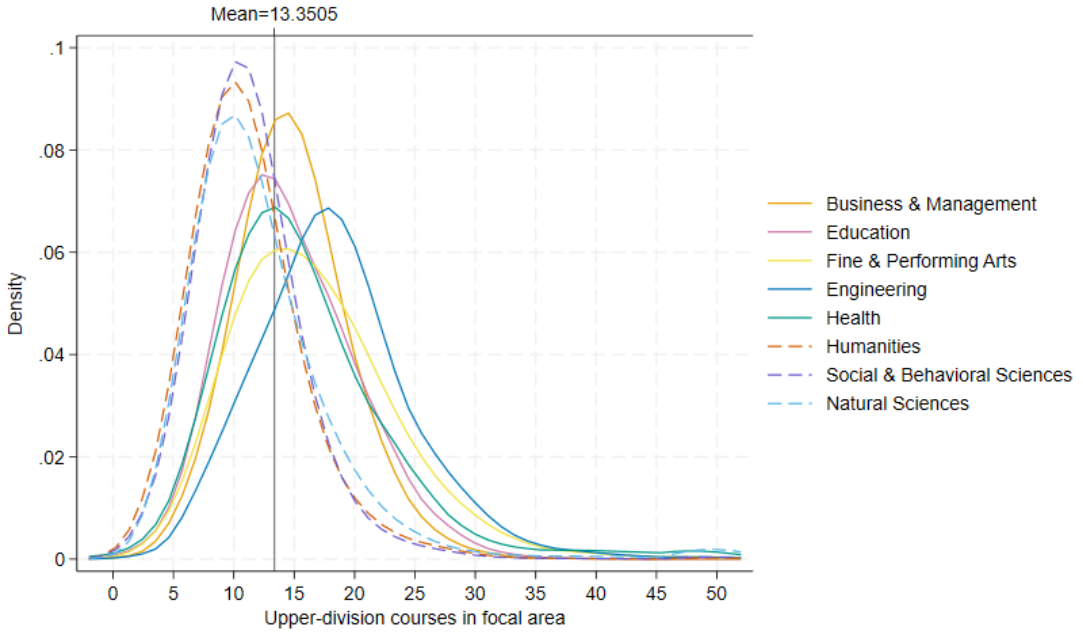
Notes. Figures report the average depth, breadth, and liberal education index (LEI) across fields of study. N = 287,454.

Figure 2. Distributions of Breadth and Depth, by Major

A. Overall Breadth

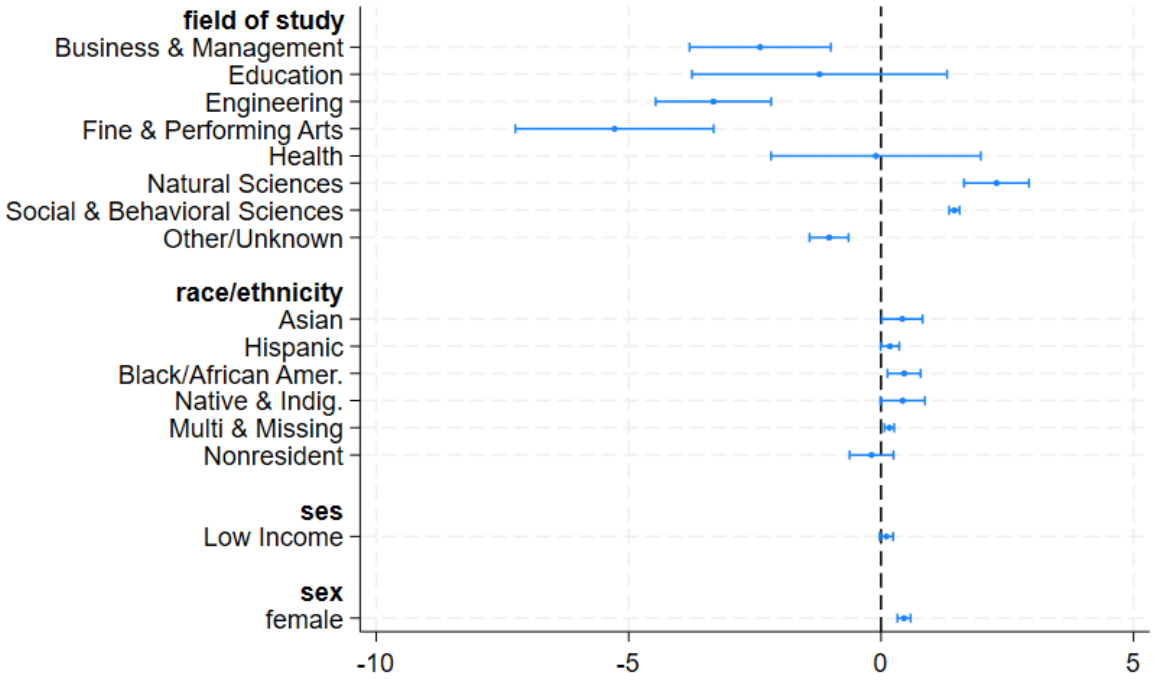


B. Depth



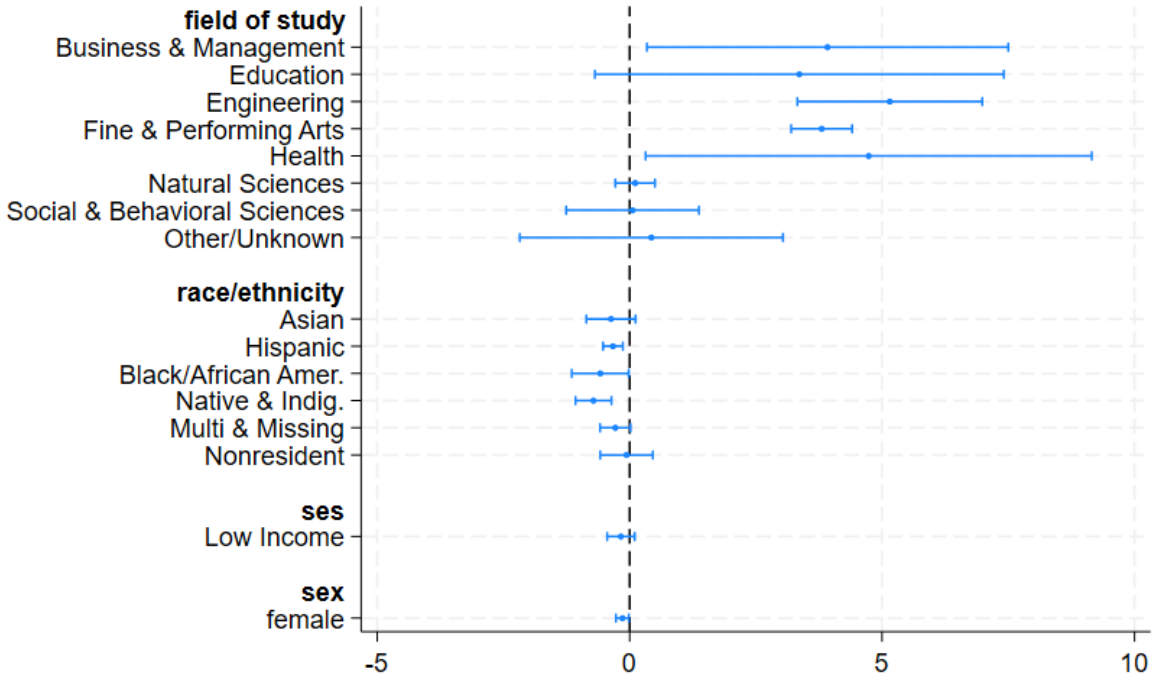
Notes. Densities are estimated using the Epanechnikov kernel (bandwidth = 2.00). N = 287,454

Figure 3. Difference in Breadth by Major and Student Characteristics, within System



Notes. Figure plots regression coefficients and 95% confidence interval on indicators for being in reported group relative to an omitted category (humanities, White, male, not from low-income neighborhood). The model includes system fixed effects, cohort fixed effects, and system by cohort fixed effects. Controls include total courses, transfer credits, HS GPA, SAT/ACT, and multiple major indicator.

Figure 4. Difference in Depth by Major and Student Characteristics, within System



Notes. Figure plots regression coefficients and 95% confidence interval on indicators for being in reported group relative to an omitted category (humanities, White, male, not from low-income neighborhood). The model includes system fixed effects, cohort fixed effects, and system by cohort fixed effects. Controls include total courses, transfer credits, HS GPA, SAT/ACT, and multiple major indicator.

Appendix

Section 1: Additional Information about Data and Measurement

Data

College and Beyond II (CBII) was funded by the Mellon Foundation to facilitate research on the nature and consequences of an undergraduate liberal arts education. The colleges that contributed data to the study are all public and range from liberal arts institutions to large research universities. They are: Georgia College and State University, Indiana University, Truman State University, University of California at Irvine, University of Houston, University of Michigan (Ann Arbor), and all the four-year institutions in the City University of New York (CUNY) system. The systems are anonymized in the data and provided with the random study identifiers of A-G, although we do not use data from System G in our analyses due to its substantial missing data on course titles, which are required for classifying course content. The data includes student background information at the time of enrollment, course transcript records, information about course subjects, term-level information about majors and grades, and final degree information. Relative to the postsecondary education transcript studies (PETS) collected periodically by the National Center for Educational Statistics (NCES) or state longitudinal data systems, CBII provides the advantage of very large samples (facilitates study of small groups), the universe of all students co-enrolled together (facilitates measurement of classroom context), many entry and graduating cohorts, and institutions spread across multiple states. For instance, when creating our measures of curricular depth (discussed in more detail below), we are able to calculate the share of students' classmates who are juniors and seniors, which is not possible with PETS data.

Sample

Appendix Table A1 reports descriptive characteristics of our analytical sample. Our sample is roughly similar to students graduating from four-year colleges nationally, with 57% female, 18% coming from a low-income neighborhood, and slightly more than half reported as non-white (14% Asian, 13% Hispanic, 10% black, and 5% multi-racial or race not provided).

Measures

Field of study. The CBII data includes the CIP code for the field of study in which students were awarded a bachelor's degree. Using this CIP code, we aggregate students' majors into nine fields of study following the American Academy of Arts and Sciences' categorization: Business & Management, Education, Engineering, Fine Performance Arts, Health, Humanities, Natural Sciences, Social Sciences, and Others. By merging the CBII student data file and term data file, we also extract each student's declared major(s) at the end of each term and construct a dummy variable to indicate whether students declared more than one major during undergraduate studies.

Student's family SES background. Ideally, we would measure a student's socioeconomic status with detailed information about their family income and parents' level of education while they were in college. However, the data institutions provided to the CBII study on income and parental education cannot be standardized across systems due to inconsistent levels of detail and missing data across institutions. Therefore, we measure whether a student comes from a low socioeconomic family background by identifying whether students were living in a low-income neighborhood when they entered college. Specifically, we match students' permanent zip code during college with the ZIP Code Tabulation Area in the National Neighborhood Data Archive (NaNDA) dataset (Melendez et al., 2020). NaNDA contains data derived from the U.S. Census

on the average proportion of people in each ZIP Code with income in the past 12 months below the poverty level from 2008 to 2012 and from 2013 to 2017. Because the CBII data spans 2000 to 2021, we take the average of these two periods. Family income and parental education are measured inconsistently across systems in the CBII data. That means that some systems have data on whether a student is low-income, and others do not. We use "LOWINC_famic" (the indicator for whether a student is low-income) in System G with the NaNDA data as a reference and adopt a data-driven approach, trying to find a zip code poverty rate cutoff that can minimize the sum of observations from System G that should be categorized as "low income" but are identified as "not low income" and observations that should have been categorized as "not low income" but are identified as "low income." We find that when adopting the poverty rate cutoff of 0.17, the number of miscategorizations is minimized. Therefore, we define a student's "low income status" as equal to 1 if the mean poverty rate of their permanent address zip code is greater than 0.17.

Though we use a data-driven approach to determine the cutoff when constructing the SES dummy, this cutoff value is close to the USDA Economic Research Service's (2025) poverty rate threshold of 0.20 used to categorize a zip code as being a low-income community. Also, as a robustness check, we replace our neighborhood-based SES proxy with a low-family-income dummy derived from the CBII family income measure (categorical ranges converted to midpoints; low income defined as the bottom income quantile and Pell Grant receipt). We then replicate the main analyses separately for Systems A, B, E, and F and in a pooled specification with system fixed effects; Systems C and D are excluded because they do not report family income. Results are quantitatively and qualitatively similar when using different measurements of students' family SES background, albeit with reduced sample sizes when using the actual

family income variable due to income missingness. Furthermore, theoretically, residential measurements may be able to capture the broader "contextual mechanisms," such as local institutional resources and peer environments, through which social stratification operates (Sharkey & Faber, 2014).

Race/ethnicity. We categorize race and ethnicity into Asian; Hispanic; Black; American Indian, Alaskan, Hawaiian, and Pacific Islander; multi-racial and unknown; White; and nonresident. We recognize that these categories are not as nuanced as ideal. They largely reflect the way race is measured by the institutions that provided data to the CBII study.

Sex. Sex is measured by a binary variable: male or female. We acknowledge that this coding does not capture the full range of gender identity.

Pre-college preparation. While the CBII data contains standardized test scores, there is a substantial amount of missing data. We impute the missing values of SAT verbal and math scores, ACT English and math scores, accepted transferred credits, and high school GPA with their global means and all regression models include indicators for whether these variables were imputed. Students' standardized high school GPA and accepted transferred credits are retrieved from the student data file.

Cohort. In the CBII student data file, entry terms are standardized using a term code that captures both the academic year and the term within the year. We group Fall, Winter, Spring, and Summer terms into a single academic year and define students who entered within the same academic year as belonging to the same cohort. Since we exclude students identified as transfer students by the institutions, cohort primarily refers to students' first year in college.

Alternative measures of breadth. As an alternative definition of breadth, which we use to examine the robustness of our findings, we count distinct subjects across all disciplines, not just disciplines in liberal

arts fields. The average for this measure is 18.9 and 11.0, using four- or two-digit CCM codes to define subjects, respectively. Our preferred measure limits the count to only subjects in liberal arts fields so as to align our definition of liberal education with the notion that liberal education builds students' knowledge of human cultures and the natural and physical world (i.e., the humanities, social sciences, physical sciences, and biological sciences). That is, students are not considered as gaining breadth by taking courses in Marketing, Accounting, Finance, and Management, but do by taking courses in Anthropology, Economics, Sociology, and Psychology. In **Appendix Table A2,** we provide our list of CIP/CCM codes in liberal arts fields from a table provided by the Humanities Indicators Project.

Alternative measures of depth. As alternative measures of depth, we also count the number of upper-level courses in any field (top-coded at 99.9 percentile) and the number of upper-level courses with the same 2-digit CIP codes as the awarded degree major (top-coded at the 99.9th percentile). Neither of these modifications materially affects our results in the regression estimates. Also, accounting for students' course retaking behaviors only reduces the means of the above three measurements by 0.22-0.30 standard deviations relative to their original distributions. The preferred and alternative depth measures are top-coded at the 99.9th percentile, because extreme values may reflect data entry error or atypical enrollment patterns, and could disproportionately influence aggregate statistics and regression estimates.

Missing Data

In the regression analyses, ACT math and English scores, SAT math and verbal scores, high school GPA, transfer credits are imputed using their respective global mean values, while missing values for the low-income (SES) indicator are replaced with 0; dummy variables indicating whether confounders have been imputed are included.

Alternative Regression Model Specifications

Breadth. **Appendix Table A3** reports the coefficients for the bivariate and full control models for our preferred breadth measure as well as the two alternative ones. The only notable difference between the

preferred and alternative breadth measures is that when breadth is measured by the number of four-digit CCM codes taken in all subjects, business and engineering majors have greater breadth than humanities majors. This measure considers taking courses in marketing, accounting, operations, finance, and management (separate four-digit CCM codes in the same two-digit code) as contributing to breadth. Our preferred measure and the second alternative measure (number of unique two-digit codes) would not consider these subjects as contributing to breadth, which we think is more consistent with intended conceptualizations of breadth. **Appendix Figure A4** reports coefficients from regressions that include field of study, race, low-income status, and sex one-at-a-time and also with all simultaneously, but without controls. The patterns we report are largely unaffected–both qualitatively and quantitatively–by the inclusion or exclusion of controls.

Depth. **Appendix Table A4** reports the coefficients for the bivariate and full control models for our preferred depth measure as well as the two alternative ones. The most notable difference is that arts students tend to take fewer upper-division courses (our second alternative measure) than humanities majors when controls are included. **Appendix Figure A5** reports coefficients from regressions that include field of study, race, low-income status, and sex one-at-a-time and also with all simultaneously, but without controls. The patterns we report are largely unaffected–both qualitatively and quantitatively–by the inclusion or exclusion of controls.

Section 2: Additional Tables and Figures

Table A1. Summary Statistics for Analytical Sample

	Full sample (N = 287,454)		
	n/Freq.	Mean/Prop.	SD
Demographics			
Female	287,454	0.57	
Low-income	147,220	0.18	
Race	287,454		
White	153,415	0.53	
Asian	40,251	0.14	
Hispanic	36,815	0.13	
Black/African-American	28,442	0.10	
NAHPI	661	0.00	
Multi-racial and Unknown	12,973	0.05	
Non-residential	14,897	0.05	
Pre-college preparations			
ACT math scores	77,671	27.92	4.50
ACT English scores	77,672	28.01	4.75
SAT math scores	66,933	626.35	95.70
SAT verbal scores	66,883	592.36	93.55
Standardized high school GPA	152,995	3.66	0.36
Course credits accepted for transfer	120,038	14.73	19.54
College experiences			
LE measurements			
Curriculum breadth	287,454	13.98	3.90
Curriculum depth	287,454	13.35	5.92
Alternative LE measurements			
Breadth: Distinct 4-digit CCM	287,454	22.67	5.14
Breadth: Distinct 2-digit CCM	287,454	13.06	2.89
Depth: Upper-division course	287,454	24.35	8.49
Depth: Within-major upper-division course	287,454	11.71	6.46
Field of study			
Business and Management	54,578	0.19	
Education	14,939	0.05	

Engineering	25,652	0.09	
Fine & Performing Arts	11,195	0.04	
Health	13,300	0.05	
Humanities	39,505	0.14	
Natural Sciences	32,242	0.11	
Social Sciences	66,301	0.23	
Other/Unknown	29,742	0.10	
Multiple majors	287,454	0.12	0.33
Institution			
system A	75,120	0.26	
system B	7,464	0.03	
system C	22,222	0.08	
system D	10,052	0.03	
system E	109,837	0.38	
system F	62,759	0.22	
Other course-taking features			
Total number of courses taken	287,454	50.12	11.97
Humanities courses	287,454	11.95	7.36
Natural sciences courses	287,454	10.10	9.87
Social sciences courses	287,454	8.50	6.45
Business courses	287,454	5.37	8.60
Education courses	287,454	2.00	4.64
Engineering courses	287,454	2.56	6.73
Arts courses	287,454	3.76	8.00
Health courses	287,454	1.53	6.60
Other/Unknown courses	287,454	4.35	4.78

Note: Data is from the College and Beyond II Study (2000-2021). The sample is limited to non-transfer students who graduated within 8 years. Race categories from IPEDS. The table reports the raw summary statistics for ACT math and English scores, SAT math and verbal scores, HS GPA, transfer credits, and the low-income indicator. The regression analyses use imputed values. NAHPI refers to "Native American, Hawaiian, and Pacific Islander."

Table A2. CCM Codes associated with the Humanities, Social Sciences, and Natural Sciences, as classified by the AAAS Humanities Indicators Project

Code	Descriptor	Discipline
01.0103	Agricultural Economics	Social & Behavioral Sciences
04.0801	Architectural History and Criticism, General	Humanities
04.0803	Architectural Studies	Humanities
05.0101	African Studies	Humanities
05.0102	American/United States Studies/Civilization	Humanities
05.0103	Asian Studies/Civilization	Humanities
05.0104	East Asian Studies	Humanities
05.0105	Russian, Central European, East European and Eurasian Studies	Humanities
05.0106	European Studies/Civilization	Humanities
05.0107	Latin American Studies	Humanities
05.0108	Near and Middle Eastern Studies	Humanities
05.0109	Pacific Area/Pacific Rim Studies	Humanities
05.0110	Russian Studies	Humanities
05.0111	Scandinavian Studies	Humanities
05.0112	South Asian Studies	Humanities
05.0113	Southeast Asian Studies	Humanities
05.0114	Western European Studies	Humanities
05.0115	Canadian Studies	Humanities
05.0116	Balkan Studies	Humanities
05.0118	Slavic Studies	Humanities
05.0119	Caribbean Studies	Humanities
05.0120	Ural-Altaic and Central Asian Studies	Humanities
05.0121	Commonwealth Studies	Humanities
05.0122	Regional Studies (U.S., Canadian, Foreign)	Humanities
05.0123	Chinese Studies	Humanities
05.0124	French Studies	Humanities
05.0125	German Studies	Humanities
05.0126	Italian Studies	Humanities
05.0127	Japanese Studies	Humanities
05.0128	Korean Studies	Humanities
05.0130	Spanish and Iberian Studies	Humanities
05.0131	Tibetan Studies	Humanities
05.0132	Ukraine Studies	Humanities
05.0133	Irish Studies	Humanities
05.0134	Latin American and Caribbean Studies	Humanities
05.0135	Appalachian Studies	Humanities
05.0199	Area Studies, Other	Humanities
05.0200	Ethnic Studies	Humanities
05.0201	African-American/Black Studies	Humanities
05.0202	American Indian/Native American Studies	Humanities
05.0203	Hispanic-American, Puerto Rican, and Mexican-American/Chicano Studies	Humanities
05.0204	Islamic Studies	Humanities
05.0205	Jewish/Judaic Studies	Humanities
05.0206	Asian-American Studies	Humanities
05.0207	Women's Studies	Humanities
05.0208	Gay/Lesbian Studies	Humanities
05.0209	Folklore Studies	Humanities
05.0210	Disability Studies	Humanities
05.0211	Deaf Studies	Humanities
05.0212	Comparative Group Studies	Humanities
05.0299	Ethnic, Cultural Minority, Gender, and Group Studies, Other	Humanities
05.9999	Area, Ethnic, Cultural, and Gender Studies, Other.	Humanities
09.0100	Communication, General	Humanities
09.0101	Speech Communication and Rhetoric	Humanities
09.0102	Mass Communication/Media Studies	Humanities
09.0199	Communication and Media Studies, Other	Humanities
13.0601	Educational Evaluation and Research	Social & Behavioral Sciences
13.0603	Educational Statistics and Research Methods	Social & Behavioral Sciences
13.0604	Educational Assessment, Testing, And Measurement	Social & Behavioral Sciences
13.0607	Learning Sciences	Social & Behavioral Sciences

Code	Descriptor	Discipline
13.0699	Educational Assessment, Evaluation, and Research, Other	Social & Behavioral Sciences
16.0101	Foreign Languages and Literatures, General	Humanities
16.0102	Linguistics	Humanities
16.0103	Language Interpretation and Translation	Humanities
16.0104	Comparative Literature	Humanities
16.0105	Applied Linguistics	Humanities
16.0199	Linguistic, Comparative, and Related Language Studies and Services, Other	Humanities
16.0201	African Languages, Literatures, and Linguistics	Humanities
16.0300	East Asian Languages, Literatures, and Linguistics, General	Humanities
16.0301	Chinese Language and Literature	Humanities
16.0302	Japanese Language and Literature	Humanities
16.0303	Korean Language and Literature	Humanities
16.0399	East Asian Languages, Literatures, and Linguistics, Other	Humanities
16.0400	Slavic Languages, Literatures, and Linguistics, General	Humanities
16.0402	Russian Language and Literature	Humanities
16.0403	Slavic Languages, Literatures, And Linguistics, General	Humanities
16.0406	Czech Language and Literature	Humanities
16.0407	Polish Language and Literature	Humanities
16.0499	Slavic, Baltic, and Albanian Languages, Literatures, and Linguistics, Other	Humanities
16.0500	Germanic Languages, Literatures, and Linguistics, General	Humanities
16.0501	German Language and Literature	Humanities
16.0502	Scandinavian Languages, Literatures, and Linguistics	Humanities
16.0503	Danish Language and Literature	Humanities
16.0504	Dutch/Flemish Language and Literature	Humanities
16.0505	Norwegian Language and Literature	Humanities
16.0506	Swedish Language and Literature	Humanities
16.0599	Germanic Languages, Literatures, and Linguistics, Other	Humanities
16.0601	Modern Greek Language and Literature	Humanities
16.0602	Modern Greek Language And Literature	Humanities
16.0700	South Asian Languages, Literatures, and Linguistics, General	Humanities
16.0702	Sanskrit and Classical Indian Languages, Literatures, and Linguistics	Humanities
16.0703	South Asian Languages And Literatures	Humanities
16.0799	South Asian Languages, Literatures, and Linguistics, Other.	Humanities
16.0801	Iranian Languages, Literatures, and Linguistics	Humanities
16.0900	Romance Languages, Literatures, and Linguistics, General	Humanities
16.0901	French Language and Literature	Humanities
16.0902	Italian Language and Literature	Humanities
16.0904	Portuguese Language and Literature	Humanities
16.0905	Spanish Language and Literature	Humanities
16.0906	Romanian Language and Literature	Humanities
16.0908	Hispanic and Latin American Languages, Literatures, and Linguistics, General	Humanities
16.0999	Romance Languages, Literatures, and Linguistics, Other	Humanities
16.1001	American Indian/Native American Languages, Literatures, and Linguistics	Humanities
16.1100	Middle/Near Eastern and Semitic Languages, Literatures, and Linguistics, General	Humanities
16.1101	Arabic Language and Literature	Humanities
16.1102	Hebrew Language and Literature	Humanities
16.1103	Ancient Near Eastern and Biblical Languages, Literatures, and Linguistics	Humanities
16.1199	Middle/Near Eastern and Semitic Languages, Literatures, and Linguistics, Other	Humanities
16.1200	Classics and Classical Languages, Literatures, and Linguistics, General	Humanities
16.1201	Classics And Classical Languages, Literatures, And Linguistics, General	Humanities
16.1202	Ancient/Classical Greek Language and Literature	Humanities
16.1203	Latin Language and Literature	Humanities
16.1299	Classics and Classical Languages, Literatures, and Linguistics, Other	Humanities
16.1301	Celtic Languages, Literatures, and Linguistics	Humanities
16.1404	Filipino/Tagalog Language and Literature	Humanities
16.1408	Vietnamese Language and Literature	Humanities
16.1409	Hawaiian Language and Literature	Humanities
16.1501	Turkish Language and Literature	Humanities
16.1502	Uralic Languages, Literatures, and Linguistics	Humanities
16.1601	American Sign Language (ASL)	Humanities
16.1602	Linguistics of ASL and Other Sign Languages	Humanities
16.1603	Sign Language Interpretation and Translation	Humanities
16.1699	American Sign Language, Other	Humanities

Code	Descriptor	Discipline
16.1701	English as a Second Language	Humanities
16.9999	Foreign Languages, Literatures, and Linguistics, Other	Humanities
23.0101	English Language and Literature, General	Humanities
23.0301	Comparative Literature	Humanities
23.0401	English Composition. - Deleted (2010), report under 23.1301	Humanities
23.1001	Speech And Rhetorical Studies	Humanities
23.1301	Writing, General	Humanities
23.1302	Creative Writing	Humanities
23.1304	Rhetoric and Composition	Humanities
23.1399	Rhetoric and Composition/Writing Studies, Other	Humanities
23.1401	General Literature	Humanities
23.1402	American Literature (United States)	Humanities
23.1404	English Literature (British and Commonwealth)	Humanities
23.1405	Children's and Adolescent Literature	Humanities
23.1499	Literature, Other	Humanities
23.9999	English Language and Literature/Letters, Other	Humanities
24.0101	Liberal Arts and Sciences/Liberal Studies	Humanities
24.0102	General Studies	Humanities
24.0103	Humanities/Humanistic Studies	Humanities
24.0199	Liberal Arts and Sciences, General Studies and Humanities, Other	Humanities
26.0101	Biology/Biological Sciences, General	Natural Sciences
26.0102	Biomedical Sciences, General	Natural Sciences
26.0202	Biochemistry	Natural Sciences
26.0203	Biophysics	Natural Sciences
26.0204	Molecular Biology	Natural Sciences
26.0205	Molecular Biochemistry	Natural Sciences
26.0206	Molecular Biophysics	Natural Sciences
26.0207	Structural Biology	Natural Sciences
26.0209	Radiation Biology/Radiobiology	Natural Sciences
26.0210	Biochemistry and Molecular Biology	Natural Sciences
26.0299	Biochemistry, Biophysics and Molecular Biology, Other	Natural Sciences
26.0301	Botany/Plant Biology	Natural Sciences
26.0305	Plant Pathology/Phytopathology	Natural Sciences
26.0307	Plant Physiology	Natural Sciences
26.0308	Plant Molecular Biology	Natural Sciences
26.0399	Botany/Plant Biology, Other	Natural Sciences
26.0401	Cell/Cellular Biology and Histology	Natural Sciences
26.0402	Molecular Biology	Natural Sciences
26.0403	Anatomy	Natural Sciences
26.0404	Developmental Biology and Embryology	Natural Sciences
26.0406	Cell/Cellular and Molecular Biology	Natural Sciences
26.0407	Cell Biology and Anatomy	Natural Sciences
26.0499	Cell/Cellular Biology and Anatomical Sciences, Other	Natural Sciences
26.0501	Medical Microbiology And Bacteriology	Natural Sciences
26.0502	Microbiology, General	Natural Sciences
26.0503	Medical Microbiology and Bacteriology	Natural Sciences
26.0504	Virology	Natural Sciences
26.0505	Parasitology	Natural Sciences
26.0507	Immunology	Natural Sciences
26.0508	Microbiology and Immunology	Natural Sciences
26.0509	Infectious Disease and Global Health	Natural Sciences
26.0599	Microbiological Sciences and Immunology, Other	Natural Sciences
26.0601	Anatomy	Natural Sciences
26.0603	Ecology	Natural Sciences
26.0607	Marine Biology And Biological Oceanography	Natural Sciences
26.0608	Neuroscience	Natural Sciences
26.0609	Nutrition Sciences	Natural Sciences
26.0610	Parasitology	Natural Sciences
26.0611	Radiation Biology/ Radiobiology	Natural Sciences
26.0612	Toxicology	Natural Sciences
26.0613	Biotechnology	Natural Sciences
26.0614	Biometry/ Biometrics	Natural Sciences
26.0615	Biostatistics	Natural Sciences

Code	Descriptor	Discipline
26.0616	Biotechnology	Natural Sciences
26.0617	Evolutionary Biology	Natural Sciences
26.0618	Immunology	Natural Sciences
26.0619	Virology	Natural Sciences
26.0699	Miscellaneous Biological Specializations, Other	Natural Sciences
26.0701	Zoology/Animal Biology	Natural Sciences
26.0702	Entomology	Natural Sciences
26.0704	Pathology/Experimental Pathology	Natural Sciences
26.0705	Pharmacology	Natural Sciences
26.0706	Animal Physiology	Natural Sciences
26.0707	Animal Physiology	Natural Sciences
26.0708	Animal Behavior and Ethology	Natural Sciences
26.0709	Wildlife Biology	Natural Sciences
26.0788	Physiology, Human And Animal	Natural Sciences
26.0799	Zoology/Animal Biology, Other	Natural Sciences
26.0801	Genetics, General	Natural Sciences
26.0802	Molecular Genetics	Natural Sciences
26.0804	Animal Genetics	Natural Sciences
26.0805	Plant Genetics	Natural Sciences
26.0806	Human/Medical Genetics	Natural Sciences
26.0807	Genome Sciences/Genomics	Natural Sciences
26.0888	Genetics, Plant And Animal	Natural Sciences
26.0899	Genetics, Other	Natural Sciences
26.0901	Physiology, General	Natural Sciences
26.0902	Molecular Physiology	Natural Sciences
26.0903	Cell Physiology	Natural Sciences
26.0904	Endocrinology	Natural Sciences
26.0905	Reproductive Biology	Natural Sciences
26.0906	Neurobiology And Anatomy	Natural Sciences
26.0907	Cardiovascular Science	Natural Sciences
26.0908	Exercise Physiology and Kinesiology	Natural Sciences
26.0909	Vision Science/Physiological Optics	Natural Sciences
26.0910	Pathology/Experimental Pathology	Natural Sciences
26.0911	Oncology And Cancer Biology	Natural Sciences
26.0912	Aerospace Physiology and Medicine	Natural Sciences
26.0913	Biomechanics	Natural Sciences
26.0988	Medical Physiology	Natural Sciences
26.0999	Physiology, Pathology, and Related Sciences, Other	Natural Sciences
26.1001	Pharmacology	Natural Sciences
26.1002	Molecular Pharmacology	Natural Sciences
26.1003	Neuropharmacology	Natural Sciences
26.1004	Toxicology	Natural Sciences
26.1005	Molecular Toxicology	Natural Sciences
26.1006	Environmental Toxicology	Natural Sciences
26.1007	Pharmacology and Toxicology	Natural Sciences
26.1099	Pharmacology and Toxicology, Other	Natural Sciences
26.1101	Biometry/Biometrics	Natural Sciences
26.1102	Biostatistics	Natural Sciences
26.1103	Bioinformatics	Natural Sciences
26.1104	Computational Biology	Natural Sciences
26.1199	Biomathematics, Bioinformatics, and Computational Biology, Other	Natural Sciences
26.1201	Biotechnology	Natural Sciences
26.1301	Ecology	Natural Sciences
26.1302	Marine Biology and Biological Oceanography	Natural Sciences
26.1303	Evolutionary Biology	Natural Sciences
26.1304	Aquatic Biology/Limnology	Natural Sciences
26.1305	Environmental Biology	Natural Sciences
26.1306	Population Biology	Natural Sciences
26.1307	Conservation Biology	Natural Sciences
26.1308	Systematic Biology/Biological Systematics	Natural Sciences
26.1310	Ecology and Evolutionary Biology	Natural Sciences
26.1311	Epidemiology and Biostatistics	Natural Sciences
26.1399	Ecology, Evolution, Systematics and Population Biology, Other	Natural Sciences

Code	Descriptor	Discipline
26.1401	Molecular Medicine	Natural Sciences
26.1501	Neuroscience	Natural Sciences
26.1502	Neuroanatomy	Natural Sciences
26.1503	Neurobiology and Anatomy	Natural Sciences
26.1504	Neurobiology and Behavior	Natural Sciences
26.1599	Neurobiology and Neurosciences, Other	Natural Sciences
26.9999	Biological and Biomedical Sciences, Other	Natural Sciences
27.0101	Mathematics, General	Natural Sciences
27.0102	Algebra and Number Theory	Natural Sciences
27.0103	Analysis and Functional Analysis	Natural Sciences
27.0105	Topology and Foundations	Natural Sciences
27.0199	Mathematics, Other	Natural Sciences
27.0301	Applied Mathematics, General	Natural Sciences
27.0302	Operations Research	Natural Sciences
27.0303	Computational Mathematics	Natural Sciences
27.0304	Computational and Applied Mathematics	Natural Sciences
27.0305	Financial Mathematics	Natural Sciences
27.0306	Mathematical Biology	Natural Sciences
27.0399	Applied Mathematics, Other	Natural Sciences
27.0501	Statistics, General	Natural Sciences
27.0502	Mathematical Statistics and Probability	Natural Sciences
27.0503	Mathematics and Statistics	Natural Sciences
27.0599	Statistics, Other	Natural Sciences
27.0601	Applied Statistics, General	Natural Sciences
27.9999	Mathematics and Statistics, Other	Natural Sciences
30.0101	Biological and Physical Sciences	Natural Sciences
30.0501	Peace Studies and Conflict Resolution	Social & Behavioral Sciences
30.1001	Biopsychology	Natural Sciences
30.1101	Gerontology	Social & Behavioral Sciences
30.1201	Historic Preservation and Conservation, General	Humanities
30.1202	Cultural Resource Management and Policy Analysis	Social & Behavioral Sciences
30.1299	Historic Preservation and Conservation, Other	Humanities
30.1301	Medieval and Renaissance Studies	Humanities
30.1501	Science, Technology and Society	Social & Behavioral Sciences
30.1701	Behavioral Sciences	Social & Behavioral Sciences
30.1801	Natural Sciences	Natural Sciences
30.1901	Nutrition Sciences	Natural Sciences
30.2001	International/Globalization Studies	Social & Behavioral Sciences
30.2101	Holocaust and Related Studies	Humanities
30.2201	Ancient Studies/Civilization	Humanities
30.2202	Classical, Ancient Mediterranean, and Near Eastern Studies and Archaeology	Humanities
30.2301	Intercultural/Multicultural and Diversity Studies	Humanities
30.2401	Neuroscience	Natural Sciences
30.2501	Cognitive Science, General	Natural Sciences
30.2601	Cultural Studies/Critical Theory and Analysis	Humanities
30.2701	Human Biology	Natural Sciences
30.2901	Maritime Studies	Humanities
30.3101	Human Computer Interaction	Social & Behavioral Sciences
30.3201	Marine Sciences	Natural Sciences
30.3301	Sustainability Studies	Natural Sciences
30.3401	Anthrozoology	Natural Sciences
30.3501	Climate Science.	Natural Sciences
30.3601	Cultural Studies and Comparative Literature	Humanities
30.3801	Earth Systems Science	Natural Sciences
30.4001	Economics and Foreign Language/Literature	Humanities
30.4101	Environmental Geosciences	Natural Sciences
30.4301	Geobiology	Natural Sciences
30.4401	Geography and Environmental Studies	Social & Behavioral Sciences
30.4501	History and Language/Literature	Humanities
30.4601	History and Political Science	Humanities
30.4701	Linguistics and Anthropology	Humanities
30.4801	Linguistics and Computer Science	Humanities
30.4901	Mathematical Economics	Social & Behavioral Sciences

Code	Descriptor	Discipline
30.5101	Philosophy, Politics, and Economics	Humanities
30.5202	Digital Humanities.	Humanities
31.0505	Exercise Science and Kinesiology	Natural Sciences
38.0001	Philosophy and Religious Studies, General	Humanities
38.0101	Philosophy	Humanities
38.0102	Logic	Humanities
38.0103	Ethics	Humanities
38.0104	Applied and Professional Ethics	Humanities
38.0199	Philosophy, Other	Humanities
38.0201	Religion/Religious Studies	Humanities
38.0202	Buddhist Studies	Humanities
38.0203	Christian Studies	Humanities
38.0204	Hindu Studies	Humanities
38.0205	Islamic Studies	Humanities
38.0206	Jewish/Judaic Studies	Humanities
38.0208	Catholic Studies	Humanities
38.0299	Religion/Religious Studies, Other	Humanities
38.9999	Philosophy and Religious Studies, Other	Humanities
39.0101	Ancient Near Eastern And Biblical Languages, Literatures And Linguistics	Humanities
40.0101	Physical Sciences, General	Natural Sciences
40.0201	Astronomy	Natural Sciences
40.0202	Astrophysics	Natural Sciences
40.0203	Planetary Astronomy and Science	Natural Sciences
40.0299	Astronomy and Astrophysics, Other	Natural Sciences
40.0301	Astrophysics	Natural Sciences
40.0401	Atmospheric Sciences and Meteorology, General	Natural Sciences
40.0402	Atmospheric Chemistry and Climatology	Natural Sciences
40.0403	Atmospheric Physics and Dynamics	Natural Sciences
40.0404	Meteorology	Natural Sciences
40.0499	Atmospheric Sciences and Meteorology, Other	Natural Sciences
40.0501	Chemistry, General	Natural Sciences
40.0502	Analytical Chemistry	Natural Sciences
40.0503	Inorganic Chemistry	Natural Sciences
40.0504	Organic Chemistry	Natural Sciences
40.0505	Medicinal And Pharmaceutical Chemistry	Natural Sciences
40.0506	Physical Chemistry	Natural Sciences
40.0507	Polymer Chemistry	Natural Sciences
40.0508	Chemical Physics	Natural Sciences
40.0509	Environmental Chemistry	Natural Sciences
40.0510	Forensic Chemistry	Natural Sciences
40.0511	Theoretical Chemistry	Natural Sciences
40.0512	Cheminformatics/Chemistry Informatics.	Natural Sciences
40.0599	Chemistry, Other	Natural Sciences
40.0601	Geology/Earth Science, General	Natural Sciences
40.0602	Geochemistry	Natural Sciences
40.0603	Geophysics and Seismology	Natural Sciences
40.0604	Paleontology	Natural Sciences
40.0605	Hydrology and Water Resources Science	Natural Sciences
40.0606	Geochemistry And Petrology	Natural Sciences
40.0607	Oceanography, Chemical and Physical	Natural Sciences
40.0699	Geological and Earth Sciences/Geosciences, Other	Natural Sciences
40.0701	Physical Sciences, Other	Natural Sciences
40.0702	Oceanography, Chemical And Physical	Natural Sciences
40.0703	Geology/Earth Science, General	Natural Sciences
40.0799	Physical Sciences, Other	Natural Sciences
40.0801	Physics, General	Natural Sciences
40.0802	Atomic/Molecular Physics	Natural Sciences
40.0804	Elementary Particle Physics	Natural Sciences
40.0806	Nuclear Physics	Natural Sciences
40.0807	Optics/Optical Sciences	Natural Sciences
40.0808	Condensed Matter and Materials Physics	Natural Sciences
40.0809	Acoustics	Natural Sciences
40.0810	Theoretical and Mathematical Physics	Natural Sciences

Code	Descriptor	Discipline
40.0899	Physics, Other	Natural Sciences
40.1001	Materials Science	Natural Sciences
40.1002	Materials Chemistry	Natural Sciences
40.1099	Materials Sciences, Other	Natural Sciences
40.1101	Physics and Astronomy	Natural Sciences
40.9999	Physical Sciences, Other	Natural Sciences
42.0101	Psychology, General	Social & Behavioral Sciences
42.2701	Cognitive Psychology and Psycholinguistics	Social & Behavioral Sciences
42.2702	Comparative Psychology	Social & Behavioral Sciences
42.2703	Developmental and Child Psychology	Social & Behavioral Sciences
42.2704	Experimental Psychology	Social & Behavioral Sciences
42.2705	Personality Psychology	Social & Behavioral Sciences
42.2706	Behavioral Neuroscience	Social & Behavioral Sciences
42.2707	Social Psychology	Social & Behavioral Sciences
42.2708	Psychometrics and Quantitative Psychology	Social & Behavioral Sciences
42.2709	Psychopharmacology	Social & Behavioral Sciences
42.2799	Research and Experimental Psychology, Other	Social & Behavioral Sciences
42.2801	Clinical Psychology	Social & Behavioral Sciences
42.2802	Community Psychology	Social & Behavioral Sciences
42.2803	Counseling Psychology	Social & Behavioral Sciences
42.2804	Industrial and Organizational Psychology	Social & Behavioral Sciences
42.2807	Clinical Child Psychology	Social & Behavioral Sciences
42.2808	Environmental Psychology	Social & Behavioral Sciences
42.2809	Geropsychology	Social & Behavioral Sciences
42.2810	Health/Medical Psychology	Social & Behavioral Sciences
42.2811	Family Psychology	Social & Behavioral Sciences
42.2812	Forensic Psychology	Social & Behavioral Sciences
42.2813	Applied Psychology	Social & Behavioral Sciences
42.2814	Applied Behavior Analysis	Social & Behavioral Sciences
42.2815	Performance and Sport Psychology	Social & Behavioral Sciences
42.2817	Transpersonal/Spiritual Psychology	Social & Behavioral Sciences
42.2899	Clinical, Counseling and Applied Psychology, Other	Social & Behavioral Sciences
42.9999	Psychology, Other	Social & Behavioral Sciences
44.0499	Public Administration, Other	Social & Behavioral Sciences
44.0401	Public Administration	Social & Behavioral Sciences
44.0403	Transportation and Infrastructure Planning/Studies	Social & Behavioral Sciences
44.0499	Public Administration, Other	Social & Behavioral Sciences
44.0501	Public Policy Analysis, General	Social & Behavioral Sciences
44.0502	Education Policy Analysis	Social & Behavioral Sciences
44.0503	Health Policy Analysis	Social & Behavioral Sciences
44.0504	International Policy Analysis	Social & Behavioral Sciences
44.0599	Public Policy Analysis, Other	Social & Behavioral Sciences
44.9999	Public Administration and Social Service Professions, Other	Social & Behavioral Sciences
45.0101	Social Sciences, General	Social & Behavioral Sciences
45.0102	Research Methodology and Quantitative Methods	Social & Behavioral Sciences
45.0199	Social Sciences, Other	Social & Behavioral Sciences
45.0201	Anthropology, General	Social & Behavioral Sciences
45.0202	Physical and Biological Anthropology	Social & Behavioral Sciences
45.0203	Medical Anthropology	Social & Behavioral Sciences
45.0204	Cultural Anthropology	Social & Behavioral Sciences
45.0205	Forensic Anthropology.	Social & Behavioral Sciences
45.0299	Anthropology, Other	Social & Behavioral Sciences
45.0301	Archeology	Humanities
45.0401	Criminology	Social & Behavioral Sciences
45.0501	Demography and Population Studies	Social & Behavioral Sciences
45.0502	Applied Demography	Social & Behavioral Sciences
45.0601	Economics, General	Social & Behavioral Sciences
45.0602	Applied Economics	Social & Behavioral Sciences
45.0603	Econometrics and Quantitative Economics	Social & Behavioral Sciences
45.0604	Development Economics and International Development	Social & Behavioral Sciences
45.0605	International Economics	Social & Behavioral Sciences
45.0699	Economics, Other	Social & Behavioral Sciences
45.0701	Geography	Social & Behavioral Sciences

Code	Descriptor	Discipline
45.0799	Geography, Other	Social & Behavioral Sciences
45.0801	History, General	Humanities
45.0802	American History United States	Humanities
45.0803	European History	Humanities
45.0804	History And Philosophy Of Science/Technology	Humanities
45.0805	Public/Applied History	Humanities
45.0899	History, Other	Humanities
45.0901	International Relations and Affairs	Social & Behavioral Sciences
45.0902	National Security Policy Studies	Social & Behavioral Sciences
45.0999	International Relations and National Security Studies, Other	Social & Behavioral Sciences
45.1001	Political Science and Government, General	Social & Behavioral Sciences
45.1002	American Government and Politics (United States)	Social & Behavioral Sciences
45.1004	Political Economy	Social & Behavioral Sciences
45.1099	Political Science and Government, Other	Social & Behavioral Sciences
45.1101	Sociology, General	Social & Behavioral Sciences
45.1102	Applied/Public Sociology	Social & Behavioral Sciences
45.1103	Rural Sociology	Social & Behavioral Sciences
45.1201	Urban Studies/Affairs	Social & Behavioral Sciences
45.1301	Sociology and Anthropology	Social & Behavioral Sciences
45.1401	Rural Sociology	Social & Behavioral Sciences
45.9999	Social Sciences, Other	Social & Behavioral Sciences
50.0504	Playwriting and Screenwriting	Humanities
50.0505	Theatre Literature, History and Criticism	Humanities
50.0601	Film/Cinema/Media Studies	Humanities
50.0703	Art History, Criticism and Conservation	Humanities
50.0902	Music History, Literature, and Theory	Humanities
50.0904	Music Theory and Composition	Humanities
50.0905	Musicology and Ethnomusicology	Humanities
50.0910	Jazz/Jazz Studies	Humanities
51.0205	Sign Language Interpretation And Translation	Humanities
51.3201	Bioethics/Medical Ethics	Humanities
51.3204	Medical/Health Humanities	Humanities
51.3205	History of Medicine	Humanities
51.3299	Health Professions Education, Ethics, and Humanities, Other	Humanities
52.1302	Business Statistics	Natural Sciences
52.1304	Actuarial Science	Natural Sciences
54.0101	History, General	Humanities
54.0102	American History (United States)	Humanities
54.0103	European History	Humanities
54.0104	History and Philosophy of Science and Technology	Humanities
54.0105	Public/Applied History	Humanities
54.0106	Asian History	Humanities
54.0108	Military History	Humanities
54.0199	History, Other	Humanities

Table A3. Difference in Breadth by Field of Study and Student Characteristics (Preferred and Alternative Breadth Measures)

	Preferred Breadth Measure		**Alternative Breadth Measures**			
	Num. distinct 4-digit CCM codes in humanities, natural, and social sciences courses (mean =13.98)		Num. distinct 4-digit CCM codes in all subjects (mean =22.67)		Num. distinct 2-digit CCM codes in all subjects (mean =13.06)	
	Bivariate	Multi. (w controls)	Bivariate	Multi. (w controls)	Bivariate	Multi. (w controls)
Field (ref. Humanities)						
Business & Mngmt.	-2.5069**	-2.3946***	2.7833**	2.6104**	(0.863)	(0.787)
	(0.687)	(0.545)	(1.037)	(0.854)	(0.922)	(0.778)
Education	(0.862)	(1.220)	1.780	0.791	0.048	(0.321)
	(0.936)	(0.983)	(1.498)	(1.543)	(0.926)	(1.017)
Engineering	-3.0957***	-3.3210***	3.1439***	2.0317***	-0.9740***	-1.2190***
	(0.423)	(0.445)	(0.395)	(0.377)	(0.154)	(0.150)
Fine & Performing Arts	-4.5206***	-5.2809***	-4.2776***	-5.9781***	-2.4899**	-3.0678***
	(0.762)	(0.764)	(1.028)	(1.198)	(0.691)	(0.729)
Health	0.236	(0.103)	1.355	0.621	0.133	(0.170)
	(0.786)	(0.808)	(0.982)	(1.102)	(0.626)	(0.660)
Natural Sciences	2.6769***	2.2858***	1.6273*	0.600	-0.4543**	-0.7252***
	(0.395)	(0.250)	(0.725)	(0.373)	(0.157)	(0.146)
Social Sciences	1.5387***	1.4507***	1.5368***	1.2265***	0.3996***	0.2948**
	(0.083)	(0.040)	(0.267)	(0.292)	(0.067)	(0.077)
Other/Unknown	-0.8726***	-1.0309***	1.9992***	1.3789***	0.8599**	0.6362*
	(0.182)	(0.150)	(0.446)	(0.270)	(0.245)	(0.286)
Race (ref. White)						
Asian	0.427	0.4193**	1.2402***	0.209	0.030	(0.004)
	(0.231)	(0.157)	(0.123)	(0.143)	(0.092)	(0.061)
Hispanic	0.4783***	0.1764*	0.8033***	0.3339**	0.5889***	0.2812*
	(0.074)	(0.072)	(0.060)	(0.120)	(0.110)	(0.125)
Black African	1.1188***	0.4551**	1.6499***	0.7099**	0.9862***	0.4962***
	(0.265)	(0.128)	(0.202)	(0.218)	(0.133)	(0.034)
NAHPI	0.7547*	0.4268*	1.1436**	0.429	0.5538***	0.2759**
	(0.312)	(0.171)	(0.378)	(0.248)	(0.137)	(0.093)
Multi-race & Unknown	0.181	0.1631***	0.2003**	0.075	0.120	0.075
	(0.107)	(0.038)	(0.075)	(0.085)	(0.061)	(0.049)
Nonresident	-0.8081*	(0.190)	0.9323***	(0.001)	(0.279)	(0.167)
	(0.380)	(0.169)	(0.123)		(0.197)	(0.119)
Low-income	0.5623**	0.1043*	0.4606**	0.111	0.3794**	0.098

(ref. Non-low income)	(0.188)	(0.052)	(0.137)	(0.068)	(0.097)	(0.074)
Female	0.9234***	0.4532***	(0.303)	0.3102**	0.3769***	0.2493***
(ref. Male)	(0.154)	(0.051)	(0.206)	(0.080)	(0.054)	(0.048)
Total courses taken		0.0895***		0.1908***		0.0595**
		(0.016)		(0.030)		(0.015)
Std. HS GPA		-0.3931*		-1.4990*		-0.9981*
		(0.181)		(0.673)		(0.432)
Transfer credits		-0.0014		0.0220		0.0057
		(0.008)		(0.012)		(0.007)
SAT math scores		-0.0013**		0.0015		0.0001
		(0.000)		(0.001)		(0.000)
SAT verbal scores		-0.0004		-0.0039**		-0.0011*
		(0.001)		(0.001)		(0.000)
ACT English scores		-0.0001		-0.0153		-0.0082
		(0.009)		(0.016)		(0.011)
ACT math scores		-0.0271		0.0104		-0.0068
		(0.018)		(0.021)		(0.008)
More than 1 major		-0.8737***		-1.9886***		-1.0623*
		(0.166)		(0.467)		(0.466)
Constant		11.2964***		14.3118***		12.9011***
		(1.264)		(2.602)		(1.528)
Observations	-	287,454	-	287,454	-	287,454
R-squared	-	0.459	-	0.404	-	0.326
cohortFE, systemFE	yes	yes	yes	yes	yes	yes
sysFE × cohortFE	yes	yes	yes	yes	yes	yes
Controls	no	yes	no	yes	no	yes

Notes. Standard errors are clustered by cohort and system and shown in parentheses. 'Bivariate' columns contain the results of four separately estimated bivariate regressions (field of study and breadth; race/ethnicity and breadth; low-income and breadth; female and breadth).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A4. Difference in Depth by Field of Study and Student Characteristics (Preferred and Alternative Depth Measures)

	Preferred Depth Measure		**Alternative Depth Measures**			
	Num. upper-level, within-major courses (defined by the most frequently appearing 2-digit CIP) (mean = 13.35)		Num. upper-level, within-major courses (defined by 2 digit CIP of the awarded degree) (mean = 11.66)		Num. upper-level courses (mean = 24.39)	
	Bivariate	Multi. (w controls)	Bivariate	Multi. (w controls)	Bivariate	Multi. (w controls)
Field (ref. Humanities)						
Business & Mngmt.	4.3577**	3.9365**	5.3926**	5.0968**	1.0202*	0.5752
	(1.405)	(1.405)	(1.828)	(1.853)	(0.413)	(0.312)
Education	3.9966**	3.3547*	2.7853	2.4146	2.9013***	1.8865***
	(1.445)	(1.573)	(2.015)	(2.205)	(0.569)	(0.210)
Engineering	6.6724***	5.1613***	5.9584***	5.1855***	2.9873***	0.8827
	(1.037)	(0.713)	(1.148)	(1.210)	(0.686)	(0.648)
Fine & Performing Arts	5.7834***	3.7992***	5.5499***	4.5988***	1.8492*	-1.7990***
	(0.454)	(0.236)	(0.929)	(1.062)	(0.880)	(0.431)
Health	5.0711**	4.7287**	3.7571	3.5515	2.3499***	1.7902**
	(1.596)	(1.713)	(2.278)	(2.388)	(0.289)	(0.572)
Natural Sciences	1.3935	0.1081	1.3302	0.6705	1.6255	-0.4283
	(0.737)	(0.155)	(0.728)	(0.600)	(0.920)	(0.453)
Social Sciences	0.2601	0.0652	1.1363	1.0121	-0.2079	-0.4447**
	(0.476)	(0.518)	(0.695)	(0.769)	(0.190)	(0.153)
Other/Unknown	0.8313	0.4216	-0.2690	-0.5119	0.5951	-0.0144
	(1.084)	(1.009)	(1.453)	(1.470)	(0.510)	(0.386)
Race (ref. White)						
Asian	0.9661**	-0.3733	0.8987*	-0.1458	1.4548***	-0.2072*
	(0.276)	(0.191)	(0.373)	(0.241)	(0.280)	(0.085)
Hispanic	-0.1223	-0.3292***	-0.1632	-0.0504	0.8786*	0.0125
	(0.154)	(0.076)	(0.182)	(0.091)	(0.386)	(0.120)
Black/African Amer	0.0307	-0.5806**	-0.0940	-0.1882	2.0030**	0.3679
	(0.438)	(0.218)	(0.544)	(0.345)	(0.614)	(0.265)
NAHPI	-0.0857	-0.7180***	0.1350	-0.1909	1.0604	-0.1744
	(0.337)	(0.139)	(0.513)	(0.268)	(0.710)	(0.266)
Multi-race & Unknown	-0.2293	-0.2849*	-0.0900	-0.1336	0.2409	0.1028
	(0.182)	(0.120)	(0.215)	(0.173)	(0.382)	(0.193)
Nonresident	1.3253***	-0.0654	1.5780***	0.3203	1.1156	-0.0503
	(0.063)	(0.205)	(0.147)	(0.181)	(0.620)	(0.553)
Low-income	-0.1255	-0.1720	-0.3745	-0.2896	0.6130	-0.1239

(ref. Non-low income)	(0.173)	(0.105)	(0.204)	(0.174)	(0.294)	(0.137)
Female	-0.9587***	-0.1497**	-0.9604***	-0.1474	-0.0563	0.4213***
(ref. Male)	(0.198)	(0.050)	(0.204)	(0.161)	(0.187)	(0.104)
Total courses taken		0.2708***		0.1273***		0.5149***
		(0.018)		(0.030)		(0.048)
Std. HS GPA		0.7068***		0.6893***		0.7549**
		(0.144)		(0.136)		(0.197)
Transfer credits		0.0068		0.0100		0.0139
		(0.007)		(0.008)		(0.011)
SAT math scores		0.0028*		0.0022		0.0016
		(0.001)		(0.002)		(0.001)
SAT verbal scores		-0.0008		-0.0029		0.0031
		(0.002)		(0.001)		(0.002)
ACT English scores		0.0095		-0.0153		0.0810**
		(0.013)		(0.016)		(0.022)
ACT math scores		0.0197		0.0027		-0.0185
		(0.019)		(0.024)		(0.027)
More than 1 major		0.4023		0.2174		1.5001**
		(0.205)		(0.810)		(0.487)
Constant		-8.1108***		0.4528		-16.5804***
		(1.604)		(2.235)		(2.567)
Observations	-	287,454	-	287,454	-	287,454
R-squared	-	0.453	-	0.203	-	0.707
CohortFE, systemFE	yes	yes	yes	yes	yes	yes
SysFE × cohortFE	yes	yes	yes	yes	yes	yes
Controls	no	yes	no	yes	no	yes

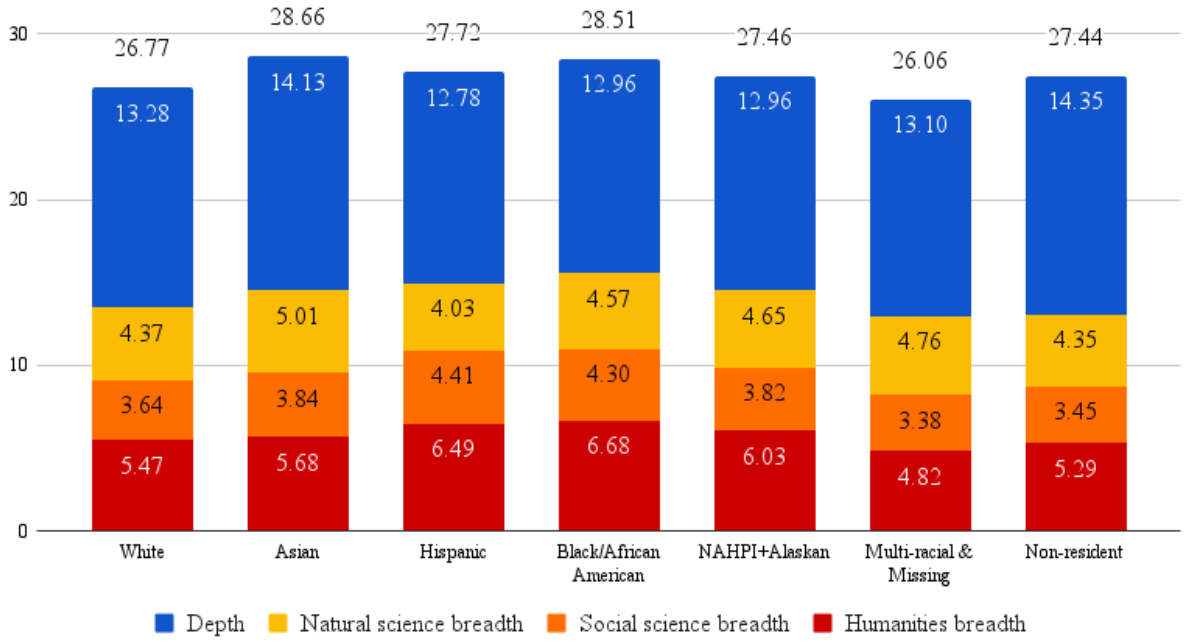
Notes. Standard errors are clustered by cohort and system and shown in parentheses. 'Bivariate' columns contain the results of four separately estimated bivariate regressions (field of study and depth; race/ethnicity and depth; low-income and depth; female and depth).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A5. Mean Number of Unique Subjects Taken in Various Domains for Students with Low (Q1) and High (Q4) Overall Breadth, by Major

Code	Domain	Business & Mngmt		Education		Engineering		Fine & Perf Arts		Health		Humanities		Natural Sciences		Social Sciences	
		unique 4 digit CCM codes		unique 4 digit CCM codes		unique 4 digit CCM codes		unique 4 digit CCM codes		unique 4 digit CCM codes		unique 4 digit CCM codes		unique 4 digit CCM codes		unique 4 digit CCM codes	
		Q1	Q4	Q1	Q4	Q1	Q4	Q1	Q4	Q1	Q4	Q1	Q4	Q1	Q4	Q1	Q4
01	Agriculture & Related Services	0.01	0.01	0.01	0.08	0.01	0.01	0.01	0.02	0.06	0.07	0.02	0.02	0.01	0.02	0.01	0.02
03	Natural Resources & Conservation	0.08	0.12	0.07	0.12	0.04	0.08	0.06	0.09	0.03	0.05	0.14	0.12	0.09	0.09	0.22	0.17
04	Architecture & Related Services	0.02	0.01	0.01	0.02	0.05	0.06	0.02	0.10	0.01	0.01	0.04	0.05	0.02	0.03	0.02	0.03
05	Area, Ethnic, Cultural, Gender Studies	0.30	0.74	0.29	0.66	0.18	0.54	0.19	0.79	0.36	0.77	0.74	1.19	0.45	0.69	0.70	1.02
09	Communication & Related Programs	0.55	0.99	0.47	0.79	0.54	0.60	0.41	0.66	0.45	0.71	1.27	0.96	0.79	0.45	0.56	0.66
10	Communications Tech. & Support Srvcs.	0.01	0.01	0.01	0.00	0.01	0.01	0.11	0.06	0.00	0.00	0.10	0.03	0.00	0.00	0.01	0.00
11	Computer & Info. Sci. & Support Srvcs.	0.83	0.99	0.23	0.32	2.62	3.31	0.26	0.36	0.23	0.33	0.33	0.36	0.73	0.29	0.40	0.34
12	Personal & Culinary Srvcs.	0.09	0.04	0.01	0.05	0.00	0.01	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
13	Education	0.12	0.16	4.03	4.07	0.18	0.25	0.42	0.53	0.36	0.63	0.44	0.77	0.52	0.22	0.30	0.35
14	Engineering	0.10	0.09	0.08	0.06	4.80	3.30	0.06	0.08	0.03	0.05	0.05	0.06	0.20	0.10	0.08	0.06
15	Engineering Tech. & Related Fields	0.05	0.04	0.04	0.03	0.64	0.51	0.07	0.07	0.01	0.03	0.03	0.03	0.07	0.04	0.04	0.03
16	Foreign Languages, Literatures, & Linguistics	0.50	0.74	0.55	1.03	0.27	0.68	0.67	1.15	0.52	1.15	1.15	1.52	0.67	1.09	0.90	1.26
19	Family & Consumer Sciences/Human Sci.	0.14	0.12	0.30	0.68	0.04	0.06	0.08	0.15	0.60	0.70	0.14	0.22	0.20	0.29	0.20	0.29
22	Legal Professions & Studies	0.06	0.08	0.05	0.07	0.01	0.02	0.02	0.03	0.01	0.01	0.07	0.07	0.01	0.01	0.16	0.08
23	English Lang. & Lit.	1.14	1.81	1.52	2.00	0.51	1.15	1.12	1.88	1.20	1.79	1.71	2.54	1.15	1.62	1.40	1.95
24	Liberal Arts., Gen. Studies & Humanities	0.21	0.44	0.15	0.33	0.13	0.37	0.17	0.43	0.14	0.34	0.39	0.47	0.32	0.49	0.34	0.46
26	Biological & Biomedical Sciences	0.27	0.80	0.61	2.06	0.17	1.22	0.21	0.81	2.66	3.66	0.33	1.43	1.36	6.99	0.44	2.13
27	Mathematics & Statistics	1.61	2.00	1.01	1.76	2.36	2.93	0.51	1.31	1.20	1.91	0.87	1.61	2.14	1.89	1.38	1.85
30	Multi/Interdisciplinary Studies	0.24	0.32	0.23	0.50	0.14	0.34	0.12	0.35	0.23	0.52	0.33	0.53	0.23	0.48	0.33	0.55
31	Parks, Recreation & Leisure Studies	0.27	0.22	0.52	0.52	0.11	0.13	0.18	0.28	0.42	0.48	0.28	0.32	0.57	0.32	0.29	0.26
32	Basic Skills & Developmental Education	0.09	0.13	0.22	0.17	0.09	0.11	0.07	0.17	0.12	0.20	0.13	0.14	0.11	0.09	0.15	0.17
34	Health-Related Knowledge & Skills	0.06	0.08	0.29	0.48	0.03	0.05	0.05	0.14	0.37	0.49	0.11	0.21	0.37	0.27	0.11	0.20
36	Leisure & Recreational Activities	0.23	0.23	0.28	0.34	0.06	0.10	0.24	0.28	0.27	0.31	0.23	0.22	0.36	0.26	0.24	0.23
37	Personal Awareness & Self-Improvement	0.04	0.04	0.04	0.09	0.01	0.02	0.01	0.04	0.09	0.11	0.03	0.05	0.06	0.04	0.05	0.05
38	Philosophy & Religious Studies	0.45	0.89	0.42	0.67	0.28	0.63	0.29	0.62	0.38	0.71	0.49	0.90	0.43	0.64	0.59	0.86
40	Physical Sciences	0.65	1.06	0.94	1.57	1.58	2.27	0.51	1.22	0.72	1.43	0.77	1.49	1.59	2.24	0.79	1.56
42	Psychology	0.45	1.41	0.80	1.92	0.35	0.81	0.36	1.13	1.32	1.90	0.56	1.59	0.67	1.76	1.27	2.95
43	Security & Related Protective Services	0.06	0.09	0.07	0.10	0.03	0.04	0.02	0.06	0.04	0.11	0.09	0.11	0.10	0.07	0.21	0.17
44	Public Admin & Social Services	0.09	0.23	0.05	0.13	0.00	0.05	0.00	0.09	0.10	0.16	0.03	0.14	0.01	0.04	0.16	0.27
45	Social Sciences	1.82	2.94	1.31	2.43	0.95	1.82	0.58	1.91	1.19	2.33	1.56	2.88	1.46	1.88	2.76	3.46
50	Visual & Performing Arts	1.21	1.33	1.61	1.54	1.05	1.35	3.12	3.84	1.13	1.42	2.29	1.83	1.21	1.14	1.50	1.45
51	Health Professions & Related Programs	0.26	0.36	0.43	1.10	0.22	0.51	0.38	0.48	2.84	4.01	0.39	0.65	0.72	1.26	0.43	0.84
52	Business, Mngmt, & Related Support Services	8.44	7.44	0.62	0.61	1.27	1.64	0.48	0.94	0.46	0.79	0.78	0.73	1.62	0.46	2.04	1.12
54	History	0.42	0.74	0.64	0.74	0.23	0.46	0.35	0.56	0.38	0.61	0.59	0.76	0.44	0.54	0.56	0.67
90	Other Courses	0.22	0.19	0.11	0.21	0.10	0.09	0.17	0.16	0.15	0.16	0.21	0.24	0.14	0.14	0.18	0.20

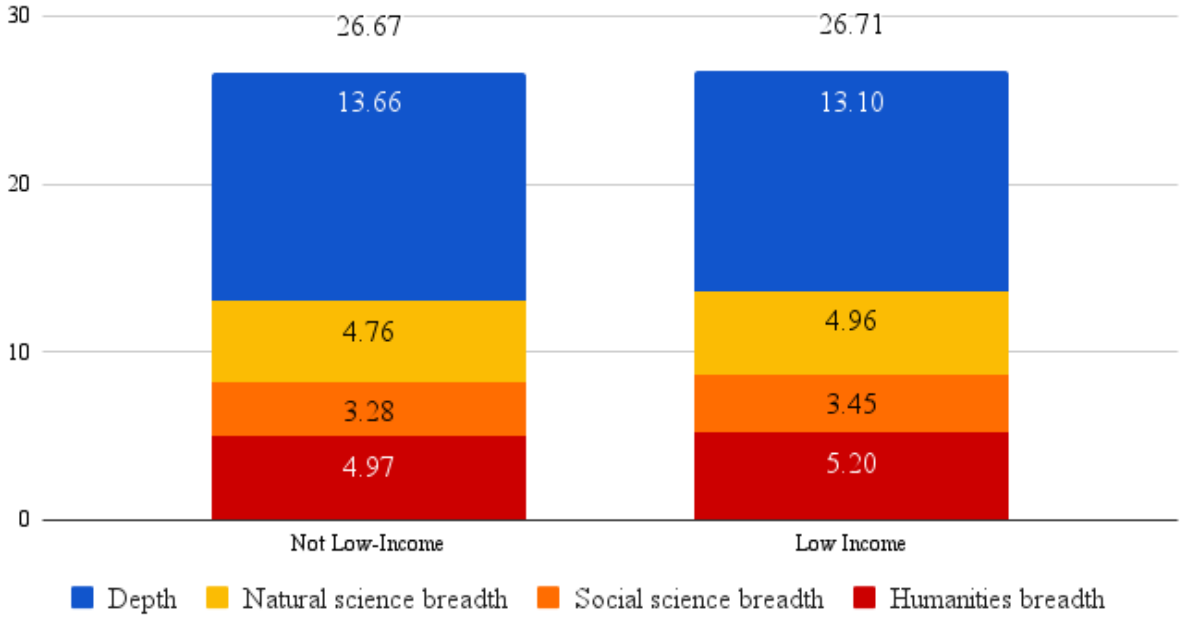
Notes: Highlighting indicates Humanities fields (yellow), Natural sciences (blue), and Social sciences (green). Q1= 1st quartile of breadth; Q4=4th quartile of breadth. CCM= College Course Map. We omit categories with fewer than 0.05 courses in all columns, including Library Science (CCM 25), Military Sci. & Leadership (28), Military Technologies (29), Citizenship Activities (33), Interpersonal & Social Skills (35), Theology & Religious Vocations (39), Science & Technologies (41), Construction Trades (46), Mechanic & Repair Technologies (47), Precision Production (48), Transportation & Materials Moving (49), Secondary Diplomas & Certificates (53), and Residency Programs (60).

Figure A1. Number of Courses that Constitute Breadth and Depth, by Race/Ethnicity



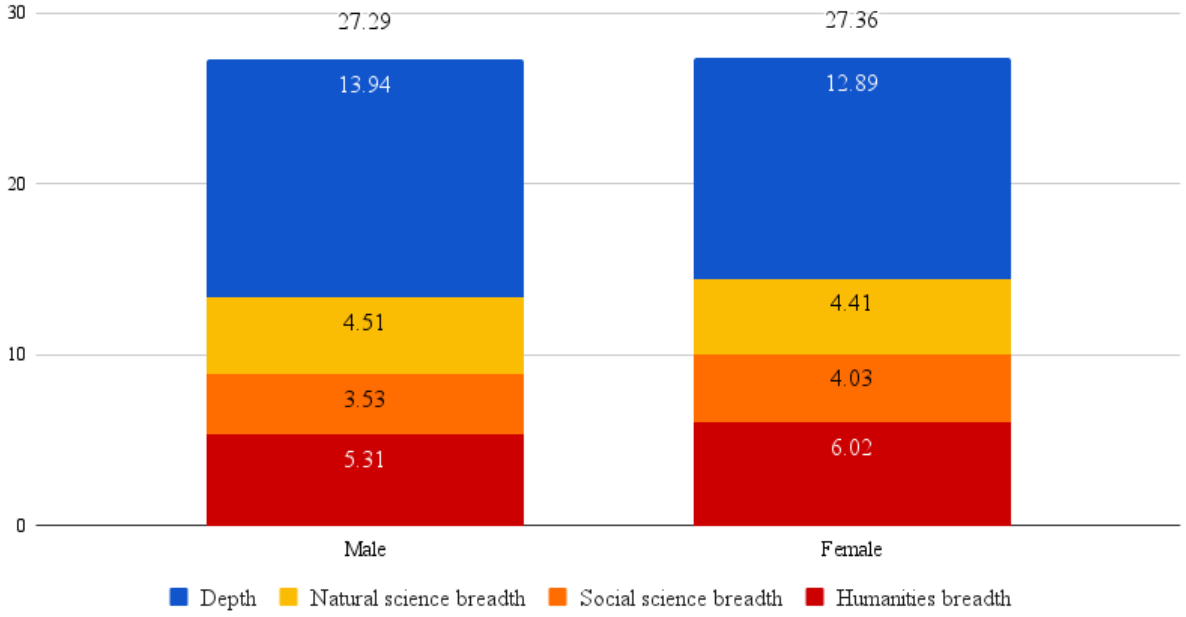
Note. NAHPI refers to "Native American, Hawaiian, and Pacific Islander." N = 287,454.

Figure A2. Number of Courses that Constitute Breadth and Depth, by SES



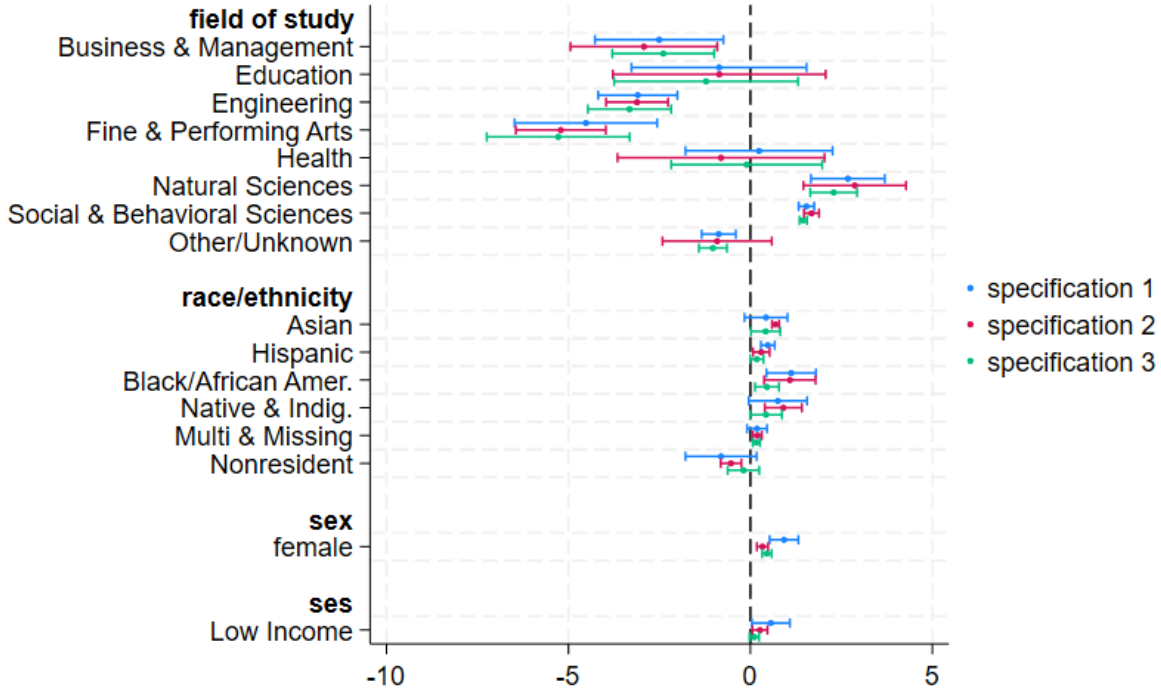
Note. N = 287,454.

Figure A3. Number of Courses that Constitute Breadth and Depth, by Sex



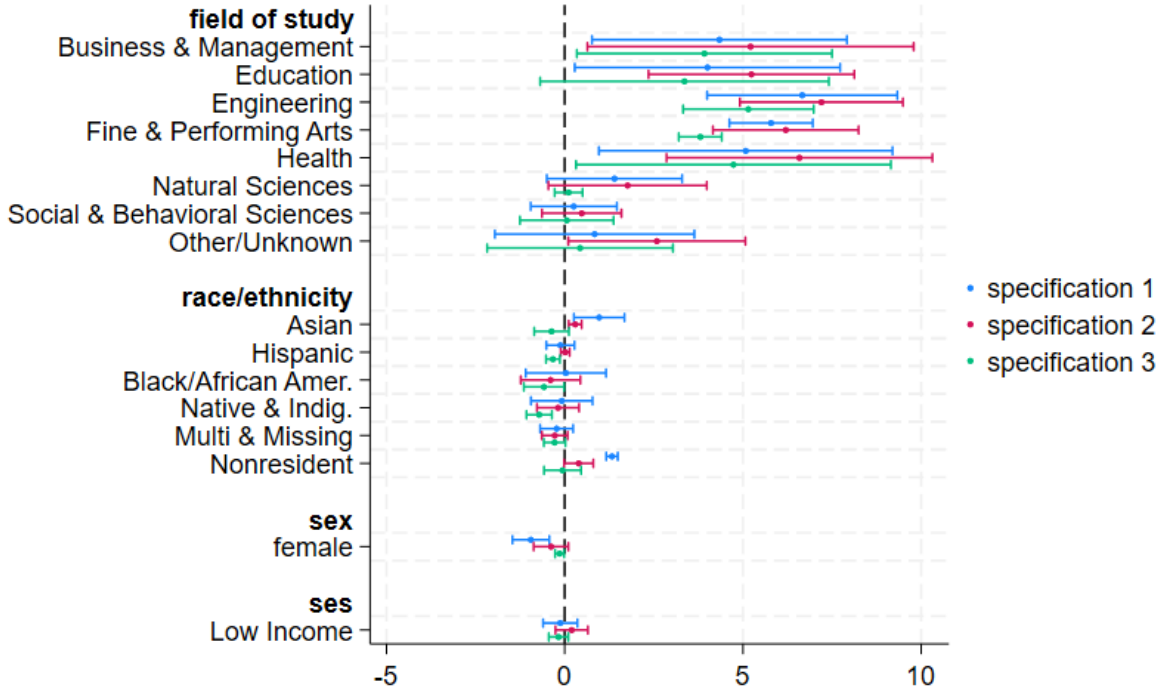
Note. N = 287,454.

Figure A4. Differences in Breadth by Major and Student Characteristics, within System



Note. Figure plots regression coefficients and 95% confidence interval on indicators for being in reported group relative to an omitted category: humanities, white, male, not-low income. Specification (1) presents a series of bivariate OLS regressions, where the LE Breadth measure is separately regressed on indicators for students' field of study, race, gender, and SES. Specification (2) reports estimates from a multivariate OLS regression of the LE Breadth on all demographic indicators jointly. Specification (3) corresponds to Equation (1) in the Methods section. All models include system fixed effects, cohort fixed effects, and system by cohort fixed effects.

Figure A5. Differences in Depth by Major and Student Characteristics, within System



Note. Figure plots regression coefficients and 95% confidence interval on indicators for being in reported group relative to an omitted category: humanities, white, male, not-low income. Specification (1) presents a series of bivariate OLS regressions, where the LE Breadth measure is separately regressed on indicators for students' field of study, race, gender, and SES. Specification (2) reports estimates from a multivariate OLS regression of the LE Breadth on all demographic indicators jointly. Specification (3) corresponds to Equation (1) in the Methods section. All models include system fixed effects, cohort fixed effects, and system by cohort fixed effects.