Academic Rigor: A Comprehensive Definition

Part one of a three-part series

Andria Foote Schwegler

Texas A&M University – Central Texas

September 12, 2019

Table of Contents

Academic Rigor

Multiple attempts to define academic rigor have not resulted in a widely accepted definition, which is posing challenges in higher education. Currently, the value of higher education is being questioned as it is not apparent to many what the purpose of higher education is or how it applies to real world and work contexts. Concerns are supported by evidence revealing limited student learning, grade inflation, and persistent achievement gaps. Given this context, the purpose of a higher education needs to be clearly articulated and enforced, and a definition of academic rigor that can be observed and improved upon may serve to facilitate this goal.

The Role of Learning in Higher Education

PURPOSE OF HIGHER EDUCATION

Discussions of academic rigor assume that the purpose of obtaining a higher education is to advance student learning, and academic rigor is a mechanism to do so. However, this focus on learning as the primary goal of higher education may not be widely shared today. Labaree (1997) described competing goals imposed upon educational institutions in the United States that have led to differing values of student learning. The initial purpose of early institutions to provide a general education so citizens could participate effectively in a democratic society (i.e., democratic equality goal) included a focus on learning so that students could use the information to make informed political decisions to support the newly established government. With the rise of employment opportunities, the goal of shaping students' educational experiences to meet labor market demands rose in prominence for educational institutions with the accompanying focus that students, based on their ability levels, needed to learn skills to find their places as effective employees in the job market and as taxpayers in the community (i.e., social efficiency goal). Despite shifts in emphasis for democratic equality and social efficiency goals across time, Labaree (1997) pointed out that a concern for one's own social mobility has increased steadily. The social mobility goal describes individual consumers' private concerns about personal status

instead of one's contributions to the public good. This goal places extrinsic value on credentials that can be exchanged for jobs and diverts focus from the intrinsic value of learning. As Labaree (1997) stated, the value of these credentials "derives not from the useful knowledge they symbolize but from the kind of job for which they can be exchanged" (p. 55). As such, the reliance on credentials to obtain jobs disassociates them from the learning that should have been required to obtain them.

Similarly, Francis (2018) noted that the lack of a shared understanding of academic rigor in higher education poses problems given the steady increase in college attendance rates, which may "indicate a degree itself suffices to signal certain skills regardless of the rigor" (p. 25). He argued that insufficient attention has been devoted to the ways academic rigor has been defined and its lasting impact on our current conceptions. To provide the context for perceptions of academic rigor in the United Stated, Francis (2018) summarized two federal reports that explicitly considered academic rigor in higher education. The Truman Commission published in 1947 focused on preparing graduate students to become faculty members capable of delivering rigorous learning experiences for students. These learning experiences were to incorporate active investigation of subjects using inquiry and discovery techniques, which were intended

to foster democratic ideals and critical thinking skills. However, as Francis (2018) noted, the report had little effect in changing policy and practice in higher education. Almost 60 years later in 2006, the Spellings Commission replaced the focus on active learning, critical thinking, and writing with a more quantitative approach to assessing the presence of rigor via standardized testing. Too, instead of educating citizens to become effective participants in democracy, the rationale for promoting academic rigor shifted to preparing students to meet the needs of their future employers. Francis (2018) cautioned that this shift in focus may narrow the coursework provided in college, reducing opportunities for students to strengthen critical thinking and writing skills, qualities that were previously fundamental to defining academic rigor. He noted that though recommendations to support academic rigor were the focus of both federal commissions, they were based on differing goals for higher education, and they have yet to make significant impact on teaching and learning in the classroom, leaving academic rigor still ill defined.

Colleges and universities themselves may be contributing to the shift in perception of the purpose of higher education by marketing a college experience that does not include a focus on academic goals and student learning. For example, Hartley and Morphew (2008) examined viewbooks (i.e., glossy pamphlets used to recruit students) published by 48 colleges and universities and noted that these documents deemphasize "the rigors of academic life" (p. 679). Though academic programs may be listed, half of the viewbooks they reviewed did not include any images of students studying. Of those that did provide such an image, only a few included a photo of a student studying alone, which is positively correlated with learning (Arum & Roksa, 2011); whereas, the majority depicted students studying with peers, which is negatively correlated with learning (Arum & Roksa, 2011, p. 100). Hartley and Morphew (2008) concluded, "…success in college requires a great deal of individual discipline and effort. That message is never conveyed" in the recruiting materials they examined (p. 680). In addition, some viewbooks did not mention what purpose higher education serves; whereas,

others couched it in terms of personal growth and economic gain. Interpreted in the context of Labaree's (1997) framework, there were few references to higher education serving the public good with messages instead indicating "an extremely privatized conception of American higher education" (p. 686). In later research, a content analysis of a dozen university websites yielded similar results; online messages portrayed via text and images emphasized the type of lifestyle students could experience while attending college instead of academic pursuits or advancing the public good (Saichaie & Morphew, 2014, p. 520). The authors conclude that "the identity of higher education has become destabilized" such that the purpose of higher education as fostering student learning is marketed as a peripheral feature of college with a focus instead on entertaining extracurricular activities and job skill training to advance one's own status (p. 520).

The 2018 *Inside Higher Ed* Survey of College and University Presidents assessed perceptions of higher education that were thought to be held by most Americans (Jaschik & Lederman, 2018). When asked about their agreement with the statement "most Americans have an accurate view of the purpose of higher education," less than 1% of college and university presidents strongly agreed, and only 13% agreed. Over half of the presidents surveyed disagreed (42%) or strongly disagreed (14%) with this statement (p. 24). Four items intended to assess reasons for inaccurate perceptions revealed that respondents agreed that a focus on student debt contributes to perceptions that college is not affordable (86%), and a focus on endowments at some institutions contributes to perceptions that most colleges are wealthy (84%); a focus on racial protests that make colleges seem unwelcoming to diversity elicited less agreement (51%). Notably, a concern that colleges have misplaced priorities was endorsed by a majority of the sample with 78% agreeing that incentives colleges offer to attract students have led to a sense that these institutions have misplaced priorities.

Unfortunately, it is not clear whether college and university presidents would agree that a renewed

emphasis on student learning would clarify the purpose of higher education because perceptions related to student learning were not included in the survey. However, the outlook may be bleak for making a focus on student learning a priority because when asked their agreement with the statement, "Anti-intellectual sentiment is growing in the US," over three-fourths of the respondents strongly agreed (40%) or agreed (37%) with the claim; whereas, less than 10% of the sample disagreed (6%) or strongly disagreed (3%) (Jaschik & Lederman, 2018, p. 34). Instead of considering student learning, presidents rated how responsible each of four factors was in contributing to declining support for higher education with 98% of presidents indicating that affordability was very (63%) or somewhat (35%) responsible. Perceptions of liberal political bias (with 81% indicating very or somewhat responsible) and of under-representation of low-income students (with 46% indicating very or somewhat responsible) also garnered support though they were less uniformly endorsed. Widely acknowledged was concern regarding "whether higher education prepares students for careers" with 95% of presidents indicating this issue was very (39%) or somewhat (56%) responsible for declining public support, with only 4% reporting it was not too responsible, and less than 1% indicating it was not responsible at all. These results reveal the perceived importance of the cost of a higher education and its role in career preparation but neglect the role of student learning.

These results are corroborated by self-reports of why adults pursue higher education. The Strada-Gallup Education Consumer Survey (2018, January) examined the main reason why adults in the U.S. decided to pursue their highest level of education. Over 86,000 education consumers responded, and the majority (i.e., 58%) indicated that getting a good job was their primary motive in making their postsecondary educational decisions, with similar response rates across all levels of educational attainment. This percentage more than doubled the number of respondents (i.e., 23%) who endorsed the next most prevalent response for pursuing higher education, "learn more and gain knowledge" (p. 2). These percentages are consistent with the claim that

students are focusing more on obtaining credentials to exchange for jobs than on learning in college. Further, individuals who failed to complete their education were more likely than those who completed their programs to indicate that their main reason for pursuing education was to learn more and gain knowledge. When describing why individuals selected the postsecondary institution they attended, very few respondents stated that their main reason pertained to learning and knowledge (i.e., declining from 8% for technical/vocational credentials to 4% for four-year and postgraduate degree completion). Reasons related to institution location, access/affordability, reputation and fit, and good job/career prospects were more widely reported than considerations related to learning.

Taken together, these findings indicate that perceptions of the purpose of a higher education may be shifting from expecting students to learn meaningful academic content and develop cognitive abilities that facilitate effective participation as a member of a broader society to obtaining credentials that can be exchanged for personal gain while overlooking the role of learning in the process. But, are these perceptions of the purpose of higher education corroborated by limited student learning and attempts to side step a rigorous academic curriculum? Some evidence appears to support these concerns.

EMPIRICAL EVIDENCE ON STUDENT LEARNING

In a widely cited report, Arum and Roksa (2011) provided evidence to document limited learning in students' first two years of college. They argued that many students are adrift with no clear goals for study and that many traditional students begin college with expectations that are not aligned with their academic pursuits, a claim that has been supported in other research (e.g., Pleitz, MacDougall, Terry, Buckley, & Campbell, 2015). Arum and Roksa (2011) acknowledged that both students and parents as consumers of higher education may put priorities such as living accommodations and social life experiences ahead of learning (p. 137).

The results of their research revealed slight gains in critical thinking, complex reasoning, and writing as measured by the College Learning Assessment (CLA) over the first three semesters of college coursework; students' test performance improved, on average, .18 standard deviations computed based on pretest scores. The authors concluded that "three semesters of college education thus have a barely noticeable impact on students' skills in critical thinking, complex reasoning, and writing" (p. 35). Similarly, in a longitudinal examination of student learning over time, Blaich and Wise (2011) reported little increase in critical thinking in the first year of college (i.e., .11 standard deviations) but noted a larger increase over time (i.e., .44 standard deviations across four years of college). Results from a longitudinal study by Roohr, Liu, and Liu (2016) support this pattern. These authors reported that a small sample of students who took the ETS Proficiency Profile more than once during their college coursework made small gains (i.e., .13 standard deviations) in the first one or two years of college on total scale scores but made larger gains in learning as their time in college increased from more than three years (i.e., .49 standard deviations) to four or five years (i.e., .61 standard deviations). Though the gains in learning were not linear, they increased over time.

Instead of measuring general skills such as critical thinking or writing, other research has assessed and reported learning gains based on content-specific indices. Instead of using standardized tests such as the CLA, these studies used assessments formulated by faculty members who taught the courses upon which the test was based. For example, Hathcoat, Sundre, and Johnston (2015) examined students' gains in quantitative and scientific reasoning from entry as freshmen to the mid-point of the undergraduate degree. They found that students who completed at least one course in the quantitative/scientific reasoning area performed significantly better than students who took none; however, results indicated that completing more than one course in the area did not further increase learning gains. These authors suggested that multiple exposures to basic-level content may not improve learning after the initial exposure. On average, students' performance

increased from .31 to .67 standard deviations over time. Mathers, Finney, and Hathcoat (2018) found comparable learning gains over the first 1.5 years of college coursework in their sample of 1,554 students, though these gains fell below faculty expectations. In their sample, students increased, on average, .56 standard deviations computed based on pretest scores on a discipline-specific test created to directly align with content area learning objectives. But, similar to the results of Hathcoat et al. (2015), gains in learning did not have the anticipated relationship with the coursework that students completed. Though students who had taken one course that was intended to strengthen their quantitative and scientific reasoning skills outperformed those who did not take such a course, students who took more than one course in these areas did not improve their performance on the posttest assessing these skills more than those who took only one course. The authors concluded, "In sum, students appear to be learning in college, though this learning cannot be attributed to intentional coursework designed to increase their knowledge and skills" (p. 1224).

Considering these results across studies reveals that tests designed to assess general skills (e.g., writing, critical thinking) indicate that students learn very little in the first two years of college; however, when tests are more closely aligned with the curriculum to which students have been exposed, gains in learning during this time increase after initial exposure. Though learning gains did not increase with repeated exposure to the curriculum, it is not clear that the courses were intentionally aligned to provide increasingly more sophisticated examination of the content. In fact, Hathcoat et al. (2015) speculated that learning gains were unlikely "across a series of courses that are designed to teach these skills at a basic level" (p. 7). If learning gains are expected across multiple courses in a content area sequence, then the course curriculum and learning outcomes should be intentionally planned across courses to enable these gains to occur, and the assessment should be explicitly aligned to measure that learning.

Though general tests are not explicitly aligned with the curriculum, even on these tests learning gains

increased considerably after the first two years before leveling off, though typically maintaining their positive trajectory. When considered longitudinally, these gains are attributed to learning during the college experience; however, no studies reviewed have included longitudinal assessment of individuals of the same age as study participants who are not enrolled in college. Given that many of these studies include traditional-aged college students, the lack of a comparison group prevents determinations of the changes that may be due to development (e.g., maturation of the brain during the early 20s) and learning from experiences that are not associated with the college curriculum and co-curriculum. An assessment of these variables may reveal reductions in the estimates provided by these general tests, concerns that are less likely to affect content-specific tests (which are more likely to reveal content-specific learning instead of learning that could be obtained in other contexts or affected by developmental stage).

The number of longitudinal studies on student learning are limited, and future research may be well advised to assess learning on content that was explicitly included in the curriculum and sequenced to promote learning gains over time. Assessments of general proficiencies that are not directly related to instruction in the learning context may be suffering from a level of specificity problem in which what is being assessed is not appropriately leveled to what was being taught and learned. As such, these assessments may be underestimating the learning that is occurring.

ACADEMIC RIGOR AS A NEGOTIABLE STANDARD

Expectations for student learning as malleable is noted by Labaree (1997) in his description of job allocation based on the quantity and quality of the education of job applicants. He argued that "the easiest and most common way for employers to measure these educational differences is by examining the level and institutional prestige of a candidate's educational credentials," which are assumed to indicate the most qualified applicants, but employers "rarely look beyond the credentials

to test this assumption" (p. 55). He argued that when viewed through the lens of their exchange value, educational credentials become a commodity to be negotiated. Labaree (1997) stated,

> After all, if exchange value is key, then it makes sense to work at acquiring the maximum number of markers for the minimum investment of time, money, and intellectual energy. The payoff for a particular credential is the same no matter how it was acquired, so it is rational behavior to try to strike a good bargain, to work at gaining a diploma, like a car, at a substantial discount. (p. 56)

An implication of this view is that students may perceive that they need to work merely toward obtaining a degree instead of attempting to learn anything in the process. This expectation may negatively impact students' desire to master the academic content of the curriculum, and it may shape their interactions with faculty members in the learning context. If the goal of a college education is to obtain a degree, then academically rigorous coursework may seem to unnecessarily impede one's progress. As such, students may seek out less demanding coursework that requires less time and effort to obtain the degree. Students may also express dissatisfaction to faculty members when faced with a demanding workload in an attempt to lower faculty members' expectations.

Though scant empirical evidence is available, Schnee (2008) found support for this mutual negotiation of standards in her qualitative examination of academic rigor in a university worker education program. Study participants included instructors, staff, and adult students, most of whom were required to complete remedial coursework upon admission. Participants in her sample noted "the practice of students resisting faculty who made greater demands" and faculty who modified "curriculum, pedagogy, and expectations accordingly" (p. 68). Participants described a cycle in which many students were unprepared for college level work, which contributed to lowered perceptions of ability held by faculty members. These perceptions were also adopted by students, who demanded

lowered expectations when academically challenged by claiming they were not able to handle the workload due to poor previous academic preparation and other demands on their time. Schnee (2008) noted that instructors had very few resources and were unable to continue to provide the academic support students needed, so they lowered their expectations for coursework to compensate. Related to these negotiations, an instructor in the sample expressed concern that students seemed to "feel entitled to good grades in exchange for their tuition, regardless of the amount or quality of their work" (Schnee, 2008, p. 68). Consistent with Labaree's (1997) claim, this sentiment reflected a belief in the exchange value of credentials that could be purchased instead of earned via the hard work of mastering the content and skills that were associated with it.

When attempting to articulate the degree of academic rigor in the program, Schnee (2008) reported large discrepancies among instructors' and students' assessments, indicating that determinations of rigor were based on comparisons to one's own previous educational experiences or future expectations. For students who had limited prior academic preparation, some indicated that the program was academically challenging. But, students who considered their education in the context of plans to attend graduate school or in the context of the harsh realities of the "real world" indicated that their education was not rigorous enough to prepare them for what they would encounter (Schnee, 2008, p. 65). Similarly, many instructors indicated that the program was not sufficiently academically rigorous. Faculty members' perceptions of insufficient rigor were supported by comparisons to their own academic experience in selective colleges and to their experiences teaching at elite universities.

Inconsistent standards when assigning grades were documented by Schutz, Drake, and Lessner (2013) in a sample of 1,559 adjunct and full-time faculty members at a community college. In their study, academic rigor was defined as faculty members' level of difficulty when assigning grades. Though most faculty members indicated they used rigorous grading standards when assigning grades during the semester (65.2%) and

for final grades (71.4%), some faculty indicated only sometimes using rigorous standards when assigning these grades (i.e., 33.4% and 27.2%, respectively). Further, though the majority (54.3%) of respondents reported that they never assigned a final grade that was higher than what a student actually earned, 44.5% of respondents indicated that they sometimes did so with 1.2% indicating they often did so. Reasons why faculty reported assigning higher grades than what students earned were not assessed, but these self-reports indicated that such grades were based on unarticulated standards of rigor that were disassociated from what faculty members perceived students had learned.

In their Survey of Community College Presidents, Jaschik and Lederman (2018) found that 57% of presidents agreed with the statement, "I worry that some reforms encouraged as part of the 'completion agenda' may not result in increased learning" with only 18% of presidents in the sample disagreeing with this statement (p. 18). However, when asked if "my community college has taken steps that improve the way our completion rates look, but don't necessarily improve student learning" only 10% of the sample agreed with the statement; whereas, 78% disagreed with it (p. 18). These results revealed concerns, though not yet fully realized, that some approaches to increase course completion rates are disassociated from the increases in student learning that should be commensurate with them.

Taken together, these reports indicated that determinations of academic rigor may be based on idiosyncratic experiences that fluctuate with the comparison context (see also Ryan, Anderson, & Birchler, 1980). And, they revealed that when faculty members and students have insufficient resources to facilitate success in academically rigorous coursework, a mutual lowering of expectations may be one of the few options available to retain students and provide them access to what should be a higher education. However, according to Schnee (2008), though students reported that the care they received in their program was related to satisfaction with the program and degree progression, participants noted concerns that the care provided may "unintentionally

diminish the academic rigor of the program and, thus, be implicated in unequal educational outcomes for the very students the program aims to serve" (p. 65). The question emerged, "Could the program truly be a caring educational space if students were not receiving the most rigorous education possible?" (Schnee, 2008, p. 65). These conversations revealed that a caring environment provided for students needs to be associated with supporting students' ability to meet high standards instead of lowering academic standards under the mistaken assumption that doing so would help students be successful.

Lowered expectations for academic performance have damaging implications because they perpetuate the inequalities students have already experienced when they apply to and enroll in college. Holding some students to lower academic standards because they have insufficient prior preparation for the rigors of college level work fails to close these gaps, and it is a social justice concern because all students are not provided access to a rigorous educational experience. Schnee (2008) argued for a "…commitment to social justice by providing students access to a high quality education, not simply a degree" (p. 78). Similar concerns regarding the equity of access to higher educational experiences were expressed by Keller (2018) who called for a new definition of academic rigor that is based on student learning instead of existing student qualities, that is "rigor as deep, inquiry- and equity-based learning that supports students in achieving their full potential" (p. 90). Existing definitions of rigor that are associated with only the most elite and academically well-prepared students (e.g., via selective admissions standards) exclude the majority of individuals, and these definitions fail to specify any qualities of the academic context that facilitate students' ability to learn. Instead, academic rigor should be grounded in qualities present in the learning context, not based on preexisting qualities of students.

Yet, the value of students' experiences was acknowledged as supporting their learning by Keller (2018) who argued, "A reframed idea of rigor explicitly recognizes that students understand learning challenges based on their life experiences, culture,

and socioeconomic background and calls institutional leaders to develop new approaches to support all students through those challenges" (p. 92). The value of applying students' life experiences to the educational context was also noted by Schnee (2008) who described a "middle ground whereby students can test the validity and generalizability of their life experience against knowledge derived through academic inquiry and vice-versa" (p. 74). The need for this middle ground was revealed when too much focus on students' own experiences interfered with their ability to engage with academic content and research-based information, lowering the academic rigor of the coursework. This balance between utilizing students' life experiences to engage with and apply academic content was described by Chen (2014) who designed a psychology course for adult learners based on adult learning principles and assessed its impact on students. Consistent with models of adult learning, Chen argued that adult learners have more life experiences than traditional students, and they should draw upon these experiences to learn in personally meaningful ways. As such, participants selected a life experience that served as the focus to apply course materials from a personal perspective. Though adult learners have a broad array of life experiences, the majority of students in the sample selected experiences from childhood or early memories, experiences that traditional college-aged students possess as well. All students in the study reported transformative growth from the experience, and Chen (2014) argued that these types of learning opportunities are critical for adult learners as "Their learning needs may not match well with current university life because the academic structure is often focused on transmission-based pedagogy" (p. 407). However, because transmission-based pedagogy exists in higher education does not imply that it best facilitates learning for traditional college students. As Hutchings et al. (2011) noted, more faculty members are moving from passive student reception of information to active engagement of students in their learning, and the importance of valuing students' perspectives was documented by Schnee (2008) who described a younger student whose personal connections to information were considered "almost worth nothing" by classmates

who were prompted to value direct experiences over personal perspectives that were based on learning (p. 73). To deny the perspectives of traditional college students because they lack direct experience or to deny the perspectives of students of any age who do not have direct experience with a given topic is to separate them from meaningful interaction with academic content that could facilitate their learning. Thus, definitions of academic rigor must acknowledge the critical role that the perspectives, life experiences, and backgrounds of all learners play in facilitating learning; it cannot exclude any students from the important work of integrating their life experiences and perspectives to interpret and apply academic content.

These concerns about social justice and the overarching purpose of higher education in equipping all students to effectively engage their professional and personal lives as citizens in a democracy make salient the critical nature of facilitating student learning and creating academically rigorous learning experiences to do so. Because the role of learning in higher education is paramount, instead of negotiating expectations for academic work, alternatives that maintain the integrity of higher education as promoting student learning must be implemented, and determinations of academic rigor cannot be based on idiosyncratic perceptions unique to individuals that are disassociated from effective teaching practices and the curriculum which underlies the credentials students are working to obtain. A definition of academic rigor that facilitates learning for all students and can be applied across learning contexts is needed with ensuing institutional changes that will facilitate its success.

Defining Academic Rigor

Regarding the purpose of higher education and the role of student learning, Francis (2018) argued that "one underlying goal for higher education institutions remains similar to missions from previous decades: To provide an academically rigorous education that promotes democratic citizenship and prepares students to lead successful adult lives" (p. 25). This goal appears to be broadly endorsed among institutions of higher education. Though an analysis of recruiting documents provided few indicators of the academic work students would need to perform in college (Hartley & Morphew, 2008), a review of institutions' mission statements revealed that most included a reference to the type of education students would receive. Morphew and Hartley (2006) performed a thematic analysis of 299 college and university mission statements. A common element that emerged in seven of eight categories, formed by grouping institutions by their Carnegie Classification for baccalaureate and master's level and distinguishing them as either public or private, was a "liberal arts" education (p. 464); only the Master's I public category did not include a reference to the type of education students would receive in the top three elements identified in the mission statements

examined. Though the mission statements of public universities focused more on service to the region and civic duty whereas private universities emphasized student development via "programs that are academically rigorous" (p. 464), the shared and prevalent reference to a liberal arts education indicated that students would be exposed to a broad range of knowledge and have the opportunity to develop intellectual ability that could be transferred to solve a variety of problems during their higher education experiences.

QUALITIES OF RIGOR DERIVED FROM EXPERIENCE WITH TEACHING AND LEARNING

Despite the widely shared goal of providing a liberal arts education via rigorous educational experiences, finding consensus on a definition of academic rigor and its application has been problematic (e.g., Hechinger Institute, 2009). For example, Graham and Essex (2001) noted that though the concept is frequently mentioned, it is rarely defined. After a review of the literature, Graham and Essex (2001) noted that academic rigor is used to convey positive attributes of the educational

experience, but the word choice to describe this ideal has been subsequently questioned. In the context of school reform, Wraga (2010) called for terms that did not have negative connotations (e.g., rigor mortis and information unrelated to the real world), arguing instead for terms with positive connotations that better described active student learning of information that is meaningfully applied in contexts beyond the learning context (i.e., vigorous educative curriculum).

Though the terms and contexts differed, the focus on active cognitive engagement was shared in the two perspectives. Specifically, when Graham and Essex (2001) asked a small sample of faculty at their institution to provide definitions of academic rigor, the most common responses were "critical thinking, high standards and expectations, process more than product, and cognitive development" (p. 334). Though these nouns do not form a definition of academic rigor on their own, they do suggest rigor demands effortful consideration of challenging content while engaged in activities to learn instead of considering only the static, final outcome of a task. Compatible with this description, their colleagues noted that academic rigor was not "grades, memorization, or regurgitation" (p. 334).

Similarly, when asked to define academic rigor at their institution, Draeger, Hill, Hunter, and Mahler (2013) noticed that faculty members initially had a difficult time articulating what it was. But, when provided items assessed by the National Survey of Student Engagement (NSSE) to rate as more or less important to rigor, faculty members responded that key indicators of academic rigor included coursework that emphasized analysis, evaluation, application, and synthesis. The majority of respondents also indicated that the number of hours per week students spent preparing for class was an important indicator of rigor. Less important in defining rigor for faculty members were workload-related qualities of a course including number of lengthy papers, amount of assigned reading, and whether students perceived that they worked hard in the course. Drager et al. (2013) pointed out, "This suggests that what a student learns to do with reading or in a paper (e.g., analysis

and making judgments) is more important than how many books are assigned and how many pages a student must write" (p. 272). This conclusion reveals a preference for direct measures of student learning over indirect measures that assess the learning context when considering the goal of academic rigor. Yet, both qualities of the learning context and its goal of student learning were noted. In describing a model of academic rigor from the faculty perspective as assessed in their sample, Drager et al. (2013) argued that at least four dimensions must be considered: active learning, meaningful content, higher-order thinking, and appropriate expectations. As such, the authors concluded that academic rigor was evident "when students are actively learning meaningful content with higher-order thinking at the appropriate level of expectation in a given context" (p. 268).

Subsequent research revealed that learners' definitions of academic rigor differed from those of faculty. According to Draeger, Hill, and Mahler (2015), students' definitions of academic rigor in their sample tended to be based on workload-related elements such as the number of lengthy papers written, amount of reading, and number of hours per week spent preparing for class. Less commonly noted in students' notions of rigor were expectations to engage in higher-order thinking including synthesis, application, evaluation, and analysis. And, as discovered through focus groups, students also mentioned that strict grading was related to rigor.

This divergence in students' and faculty members' definitions of rigor reveals that the nature and purpose of rigorous academic experiences are not widely shared, an unsurprising outcome when rigor is not explicitly defined, communicated, and measured. Though an instructor's objective when assigning a paper may be to have students apply course content to an issue and synthesize conflicting viewpoints, students may view the assignment as merely having to write a paper without understanding the type of cognitive processing and mental manipulation of information required to do so. When failing to grasp the purpose of an experience in promoting learning, students may focus instead on elements of an assignment that are not directly related to learning

such as the number of pages required to earn a satisfactory grade or whether the teacher will grade on a curve. Students may also view such assignments as an obstacle to the credential they seek instead of as a technique to develop habits of thought they will need in utilizing their educational experiences effectively in their lives. Explicit discussions of how course activities promote learning and examples of how this learning can be utilized in the real world may clarify why rigorous academic experiences are needed and how they should be engaged.

Supporting this recommendation, Whitaker (2016) argued, "The absence of critical conversation about rigor in higher education has engendered the belief that academic rigor is an automatic and obvious component of college coursework and therefore does not require explanation, analysis or training. The reverse is true." To clarify what academic rigor is, Whitaker contextualized it in Vygotsky's Zone of Proximal Development, a theoretical space in which a learner can perform with the assistance of others beyond what he or she can do independently. This view of rigor focused on the process of learning (i.e., the co-construction of knowledge) instead of on the product of learning (e.g., a completed assignment or grade) and shifted emphasis from teaching to learning. This focus implied that what students can do is as important as what students know. As such, rigor is "creating a learning experience in which students must seek assistance to meet learning goals" that is cognitively and emotionally engaging (p. 8). Assistance comes in the form of cultural tools such as research, books, media, software, co-learners, tutors, and teachers; these tools are so critical that a lack of rigor is reflected by their absence. From this perspective, all students, not merely those labeled remedial, need support from others to learn.

The importance of providing support for learning was also acknowledged by Graham and Essex (2001). They cautioned that academic rigor should not be equated with course difficulty because an academically rigorous course can be made less difficult by providing students with the assistance that they need to meet its academic demands. In the absence of such support, a rigorous course is difficult, an undesirable

attribute, and it is limited in facilitating learning. Similarly, Schnee (2008) recognized the critical role that academic support for all students plays in her definition of academic rigor, stated as "deep, critical, inquiry-based learning that pushes students to new levels of academic accomplishment and recognizes the importance of sufficient scaffolding for all students to reach high standards" (p. 64). These perspectives argued that for student learning to be realized, academic support for all students as they learn is necessary.

Common themes derived from experience with teaching and learning that are threaded through these descriptions reveal important characteristics for defining academic rigor. They include setting and enforcing high expectations and standards for academic performance (Draeger et al., 2013; Graham & Essex, 2001; Schnee, 2008; Whitaker, 2016); crafting learning experiences that require active cognitive engagement (Draeger et al., 2013; Graham & Essex, 2001; Schnee, 2008; Whitaker, 2016; Wraga, 2010); grounding learning experiences in the knowledge, skills, and abilities that learners will need in their personal and professional lives (Draeger et al., 2013; Whitaker, 2016; Wraga, 2010); requiring learners to spend time engaging with academic content beyond time spent in class (Draeger et al., 2013; Draeger et al., 2015); and providing academic support for learners as they engage with content and in learning experiences (Graham & Essex, 2001; Schnee, 2008; Whitaker, 2016).

These characteristics provide insight to setting and assessing the conditions for academic rigor and situate it in a context that extends beyond the physical and/or virtual walls of a classroom. Acknowledging the broader context in which learners' education will be utilized provides a basis for academic standards that is more meaningful than an assignment whose value is defined only by the course context. When students recognize that their knowledge, skills, and abilities will be applied to making decisions to inform their behavior in life and work, the need for developing these qualities takes on greater value than when they are perceived only as a way to pass the upcoming exam never to be needed again. This broader frame respects the

harsh reality that tests of one's abilities outside the learning context are not negotiable and cannot be aided by adding bonus points to a project, dropping the lowest grade, or expecting that missed skills will be remedied in the next class. Taking into account the realities that learners will face as they participate in the world of work, family, school, and society, learning experiences in higher education can be shaped to align with those authentic activities and tests to facilitate students' ability to negotiate them successfully. This alignment assumes that higher education prepares students for engaging in activities beyond specific job duties and is compatible with the mission of many institutions to provide a liberal arts education that enables students to think critically and apply their knowledge across contexts.

QUALITIES OF RIGOR DERIVED FROM PSYCHOLOGICAL RESEARCH ON HUMAN LEARNING

While the experiences of educators and learners who are engaged in the hard work of teaching and learning are valuable for providing insight into the elements that comprise academic rigor, psychological research on human learning must also be integrated into our understanding. Though there is much we do not know about learning that future research can address, it is negligent to ignore what we do know given the assumption that the purpose of academic rigor is to facilitate student learning. Bjork and Bjork (2011) pointed out that "we can be misled by our subjective impressions" when we seek to identify ways that we learn best (p. 57). For example, Kornell and Bjork (2008) demonstrated that studying paintings by multiple artists in the same block of instruction (i.e., interleaved and spaced practice) resulted in superior performance when inferring the artist on new paintings than studying multiple paintings at a time from the same artist (i.e., blocked and massed practice). However, participants self-reports of which learning approach was more effective revealed that the majority of participants thought that blocked, massed practice was more effective than interleaved, spaced practice. This finding led the researchers to conclude, "Our results also suggest that individuals responsible for the design and evaluation of

instruction that involves induction are susceptible to being very misled by their own intuitions and subjective experiences" (p. 591). As such, practices to facilitate learning must be borne out by empirical tests instead of relying on only our perceptions of what we think is effective (see also Yan, Thai, & Bjork, 2014).

Contributing to the difficulty in perceiving how to improve learning, Bjork and Bjork (2011) postulated a distinction in memory processes that may lead us to draw erroneous conclusions about how humans learn. When learning, these researchers argued that one's retrieval strength (i.e., the ease with which information is recalled) is a distinct process from one's storage strength (i.e., how thoroughly information in memory is associated with related information). Failing to recognize the distinction may contribute to engaging in learning activities that seem to be effective at the time but that do not facilitate long-term recall or actual learning.

Bjork and Bjork (2011) argued that retrieval strength is a result of the immediate context. As such, immediately after a learning event (e.g., attending lecture, reading a chapter) retrieval strength for the material may be high, but this ease of recall does not imply that storage strength is also high. After a delay or in a different context, the information studied may be very poorly recalled, indicating that storage strength was low and very little, if any, learning occurred. To facilitate storage strength, Bjork and Bjork (2011) recommended that learners introduce "desirable difficulties" into their learning activities (p. 58). These difficulties reduce the perceived ease of learning the information in the short-term (i.e., lowering retrieval strength), but they increase the long-term storage strength of the information, which facilitates learning because the information can be recalled over time and applied in new contexts.

Desirable difficulties demonstrated through empirical research to improve learning include varying the context in which learning occurs, spreading learning activities out over time, simultaneously learning information on separate concepts, and testing frequently (Bjork & Bjork, 2011). Regarding varying the

context, a large body of research has demonstrated that memory is affected by incidental conditions in the environment in which learning occurs, and replicating these conditions during testing can facilitate memory (for a review and meta-analysis of context effects on memory see Smith & Vela, 2001). But, this facilitation is limited because, when the context changes, the ability to recall the information is reduced. As such, learning events conducted in the same environment may increase one's sense of mastery because retrieval storage is high, aided by the context triggering memory, but storage strength could be low such that the information is unlikely to be recalled in a different context when the context clues are no longer present (Bjork & Bjork, 2011). This decline in recall indicates that the information was not deeply connected to other information, and limited learning occurred. Thus, although features of the environment can serve as a mnemonic device, it is unlikely that this type of recall, triggered by irrelevant features and limited to a particular context, would be the goal of instruction. Instead, the goal is more likely to be durable learning that can be applied across contexts so studying in a variety of contexts should facilitate this ability.

In addition to varying the context, spreading learning activities out over time is associated with improvements in memory. In a meta-analytic review of research on massed practice, in which studying was grouped with no rest interval, compared to spaced practice, in which studying was distributed over time and interspersed with rest periods, spaced practice was superior for both acquisition performance (i.e., tested immediately) and retention performance (i.e., tested after at least a 24-hour delay; Donovan & Radosevich, 1999). Though this effect was robust, it was moderated by type of task, with more complex tasks demonstrating smaller effect sizes, and length of rest periods between study sessions, indicating some tasks may need longer rest intervals than others. Future research is needed to clarify these boundary conditions. Taken together, the empirical research on varying the context while studying and distributing practice over time are consistent with one of the qualities of academic rigor noted in Draeger et al. (2013) and Draeger et al. (2015).

Participants in these studies reported that spending time preparing for class, presumably by engaging with the academic content of coursework beyond the time devoted to it in class, was a quality of rigor. This observation aligns well with the research-based evidence that learners should study in more than one environment and spread study sessions out over time to facilitate learning.

Distinct from spaced practice, simultaneously learning information on separate but related concepts (i.e., interleaved practice) has also been demonstrated to support learning. In an empirical test that controlled the effect of spacing while varying the skills practiced, Taylor and Rohrer (2010) demonstrated that interleaving information (i.e., intermingling practice of formulas for the face, edges, corners, and angles of a prism) led to superior performance on a test that required students to identify a problem type and its solution after a 24-hour delay. The researchers argued that students who had to attend to the problem type during interleaved practice to select the appropriate formula were better able to discriminate among problems than those who did not have to attend to problem type during blocked practice; blocked practice provided mere repetition of the same formula, so matching a problem type to its formula could be ignored, which ultimately impaired test performance. Though interleaving material led to superior performance at test compared to blocked practice, opposite results were obtained during the initial practice sessions. Students in the interleaving condition performed significantly worse than students in the blocked condition during initial practice of the skills. This initial performance decrement with long-term learning benefit at later testing is consistent with the distinction between retrieval strength (i.e., performance in the immediate context) and storage strength (i.e., performance after a delay or in a new context) theorized by Bjork and Bjork (2011). As such, interleaving information during study provides a desirable difficulty such that initial performance is impaired but later performance is facilitated.

Empirical research also supports frequent testing to promote learning. Roediger and Karpicke (2006) summarized the results of several studies demonstrating that testing has a direct effect on memory in addition to the mediated effects it may have. Regarding the mediating effects, frequent tests may facilitate learning indirectly via a variety of behaviors such as motivating students to study at regular intervals, providing opportunities to learn from mistakes, and presenting clues to important concepts and so on, but even beyond these behaviors, the mere act of testing memory has a direct effect on learning. In other words, taking a test is more beneficial to learning than spending a comparable amount of time restudying the information. Though repeated studying may have short-term learning benefits (similar to blocked vs. interleaved practice), when retested after a delay, those who took a test on the information performed better than those who restudied the information. These researchers suggested that the act of retrieving information from memory strengthens the memory for it, a process that is not dependent upon additional exposure to the information (e.g., overlearning). Consistent with desirable difficulties, taking a test instead of repeated studying impairs short-term learning, but it promotes long-term learning, a counterintuitive effect that may be limiting its application in educational contexts because, as Roediger and Karpicke (2006) argued, "people often do not voluntarily engage in difficult learning activities, even though such activities may improve learning" (p. 199).

Because these desirable difficulties impair initial learning, our perceptions may lead us to erroneous conclusions that they should be avoided. But, in doing so, we are not setting the conditions to promote learning, and we are not likely to realize it. We must rely on empirical research to reveal techniques to improve learning that our perceptions cannot. Further, to capitalize on the learning benefits that desirable difficulties provide, students will likely need explanations and assistance because they may resist what they initially perceive as undesirable, and — as previously argued — potentially unnecessary, difficulties.

Creating convincing arguments that desirable difficulties are beneficial to learning may be made more difficult by the tendency of learners to underestimate the need for and value of studying. Unfortunately, those who most need to study to improve skills (i.e., performing in the lowest quartile on tests) are at the greatest risk of not realizing their own lack of competence (i.e., the Dunning-Kruger effect). Kruger and Dunning (1999) argued that "the skills that engender competence in a particular domain are often the very same skills necessary to evaluate competence in that domain" (p. 1121). As such, when individuals lack competence in a given skill, they also lack the ability to accurately evaluate their own lack of competence. Kruger and Dunning (1999) demonstrated low-performing individuals' inability to accurately judge their own abilities in content domains including humor, logical reasoning, and English grammar. Individuals who performed in the lowest quartile reported the largest discrepancies when estimating their perceived ability and their perception of how well they performed on these tasks. These gaps in perceived vs. actual performance were attributed to deficits in metacognitive skills, which were corrected when participants were taught strategies to increase their skills. Thus, low-performing individuals can improve their performance on tasks, but they may not be likely to do so because they do not recognize their own incompetence, and they do not receive or do not effectively take advantage of the feedback they do receive.

Kornell and Bjork (2009) demonstrated a stability bias in human memory such that humans fail to predict how much their memory can change over time. In a series of experiments in which students reported their predictions of future learning, students consistently underestimated how much they would learn via repeated study and testing sessions, even in conditions in which they witnessed improvement in their performance across tests. The researchers concluded that estimates of one's memory are stable such that individuals predict little change from their current memory state despite being provided opportunities to study. These perceptions are in direct contrast to simultaneously holding the belief

that studying is beneficial for learning. Results from the research indicated that though individuals hold positive beliefs about studying, they are at risk of not applying those beliefs as they underestimate how much they can learn from studying.

AN INTEGRATED DEFINITION OF ACADEMIC RIGOR

Given memory biases and limitations in accurately perceiving conditions that promote learning, we must seek multiple routes to gain information to create practices that promote academic rigor. Research on human learning provides recommendations that are not fully captured by faculty members' and students' descriptions of academic rigor; each type of information provides unique insights. Thus, to best facilitate learning, an interdisciplinary approach that is open to new information as it develops is needed. As our knowledge of how to facilitate learning expands, the conditions to promote rigor will increase as well.

As such, academic rigor is an ongoing process of setting the conditions to promote learning. Though it is associated with desirable difficulties, cognitive effort, and time dedicated to academic tasks, academic rigor is a positive quality of the learning environment because its goal is to promote student learning, the purpose of higher education. Conceptualized as conditions that are set to facilitate learning allows these conditions to be objectively observed and evaluated along with their relationship to artifacts students produce as evidence of learning. Further, these conditions apply to any learning context; they are not limited to only higher-level courses or elite student samples (e.g., graduate work or other advanced study). Though higher-level courses will differ in curriculum and the types of cognitive effort expected, all learning contexts can be examined in terms of the conditions set to foster learning, and such an examination of context is necessary to document academic rigor. Merely stating that academic rigor exists or offering as evidence of learning static, indirect artifacts (e.g., a list of curriculum or course learning objectives, summative course grade, grade point

average, standardized test score) is insufficient to demonstrate academic rigor. Instead, teachers need opportunities to reveal how the process of academic rigor plays out in specific learning contexts. Just as academic rigor requires multiple perspectives to inform its definition, it also requires multiple lines of evidence to demonstrate its existence. *Defining academic rigor as intentionally crafted and sequenced learning activities and interactions that are supported by research and provide students the opportunity to create and demonstrate their own understanding or interpretation of information and support it with evidence allows for the consideration of multiple factors that can facilitate or undermine rigor.*

Intentionally crafted and sequenced learning activities and interactions that are supported by research

Central to this definition is the instructor's or faculty member's role in crafting and sequencing learning activities and interactions that promote learning. Because academic rigor pertains to the conditions that surround learning, the teachers' responsibility for planning learning experiences and supporting students as they pursue them is critical. Consistent with descriptions of rigor derived from experience, teachers, trainers, and others who design learning opportunities need to be aware of the knowledge, skills, and abilities that students will need in their careers so that curriculum, assignments, and projects with real world relevance are included. This recommendation from those in the field also implies that faculty members must make decisions regarding the content, lessons, and habits of thought students will need in their personal lives as citizens. Though career-related learning activities and curriculum can be benchmarked against objectively stated position descriptions, job characteristics, and/or program accreditation requirements, learning activities intended to develop knowledge related to students' civic lives is more difficult to define. To mediate the effect of personal opinions, leanings, and biases, collaboration across faculty members with an explicit articulation of the learning outcomes targeted and how they will be applied is critical. This articulation of standards makes considerations of rigor and the

lessons to be learned in general education courses and other learning opportunities not directly aligned with a specific career path essential.

Beyond these considerations, qualities of the learning environment that are known via research, or suspected and subsequently tested, to facilitate learning should be intentionally and explicitly embedded into the context. For example, the schedule for course activities could require students to engage with particular content on multiple occasions, such as completing learning checks as they read, taking an end-of-chapter quiz, then completing a comprehensive exam across chapters. This strategy would take advantage of spaced practice, the testing effect, and interleaving to facilitate learning. Alternatively, students could write and revise, based on the instructor's task-specific feedback, multiple drafts of a paper prior to submitting the final version. This iterative process would capitalize on spaced rehearsal of the content and deeper levels of processing guided by interaction with the instructor. Another alternative as suggested by Taylor and Rohrer (2010) would be to interleave multiple types of research descriptions requiring students to select the appropriate statistical analysis for the design instead of grouping several problems utilizing the same analysis, which fails to capitalize on this desirable difficulty (p. 846). Given the variety of examples that could be provided, teachers have considerable flexibility in crafting and sequencing learning activities and interactions when incorporating characteristics that support rigor to promote learning.

Opportunities for students to create their own understanding or interpretation of information

As is obvious, student learning cannot be achieved without students playing an active role in creating their own understanding or interpretation of information. As such, the teacher's role is not to tell students what to know, understand, or believe; students must figure that out for themselves through the learning activities that teachers purposefully construct for them. To develop one's understanding, students must spend time engaging with the content

in multiple ways to enable it to become embedded with other knowledge. Teachers set expectations and requirements for students' interaction with content by the choices they make related to academic rigor. A plan that lacks rigor might require that students attend lectures, read sections of a text across time, and complete only a mid-term and a final exam. This plan falls short of fostering learning because it fails to explicitly incorporate several characteristics that are known to promote learning. In such a learning context, though some students may have strong study strategies in which they routinely test themselves, study in a variety of contexts, interleave their learning by periodically reviewing previous material while studying new material, and link what they are learning to what they already know, these study strategies to foster learning cannot be assumed nor can they be demonstrated by this plan. As previously noted, many of the strategies to promote long-term learning are counterintuitive, and students are unlikely to have discovered them on their own. Even if students have been taught these study strategies, they may fail to apply them if they are not expected to use them. As discussed, these strategies introduce difficulties that students may elect to avoid if possible.

Instead, conditions to foster learning must be intentionally embedded in the learning context so students can benefit from them regardless of their own level of study skills or self-discipline to use them. Thus, a plan that demonstrates academic rigor would be one that requires students to engage with content across time in a manner that capitalizes on techniques to promote learning. For example, students may attend class to seek answers to their questions, work cooperatively with peers, or perform application activities with the guidance of the teacher; read sections of text outside of class to formulate questions and prepare for recurrent quizzes; submit written assignments that are revised based on peer and/or teacher feedback; and complete projects that require an application and integration of skills learned previously. Such a learning context would set the conditions for students to create their own understanding or interpretation of information through processes demonstrated to facilitate

learning, and an examination of the learning activities and their sequence provides evidence to support a claim of rigor because they can be directly linked to techniques that foster learning.

When conceptualized in this manner, it is clear that student learning is the sole responsibility of the student. But, students can - and should - be assisted with this task when the context is crafted in such a way that it is based on how we as humans learn, when teachers provide resources to support learners as they grapple with creating meaning, and when the context does not allow these processes to be circumvented (e.g., setting high expectations and standards that are not negotiable). When crafting opportunities for students to create their own understanding or interpretation, the learning context should not only incorporate techniques to foster learning, it must also include procedures for protecting learning. Teachers are responsible for creating conditions in which students will not be rewarded for social loafing (e.g., Harding, 2018), cheating, guessing, or providing minimal evidence of work. Instead, the context must be designed so that learning is protected by strategies such as holding students individually accountable for their work and not providing credit for work that was not performed.

Opportunities for students to demonstrate their understanding or interpretation of information

To prevent efforts to circumvent engagement in learning tasks, providing opportunities for students to demonstrate their own understanding or interpretation of information is essential. These demonstrations provide evidence that students are engaging with the academic content as expected in the plan for learning. Without student-produced artifacts related to the learning context, there is no evidence that students are engaged in learning. For example, though teachers may assume that students are reading text material because it was assigned, in the absence of a student-produced artifact related to that assignment, there is no evidence the reading was actually completed. By providing students opportunities to demonstrate their understanding or interpretation on an ongoing

basis, teachers are not only facilitating learning they are also creating opportunities to document academic rigor. But, rigor cannot be demonstrated through simple heuristics such as the sheer number or length of assignments that students must submit. As noted in the description of rigor derived from experience, students must be engaged in higher-order thinking via active cognitive engagement with the task (e.g., Draeger et al., 2013). These processes are also required of teachers, administrators, and others as they assess the conditions set to support claims of academic rigor. Instead of simple short cuts, a thoughtful examination of the learning context, how it capitalizes on techniques to facilitate learning, and the alignment of student artifacts to demonstrate learning based on the content and learning objectives must be considered.

The nature of student-produced artifacts to demonstrate understanding or interpretation will vary based on qualities of the learning context, such as the curriculum and the stated learning outcomes. For example, the level of the course (e.g., introductory vs. advanced) will require that students engage the content and demonstrate their mastery of it in different ways. Students who are initially learning concepts may be expected to demonstrate their understanding or interpretation of the information by providing evidence that they comprehend it or can apply it to solve closely related problems. Students who have more experience with the content (e.g., seniors, graduate students) will be expected to engage in more complex cognitive tasks such as analyzing, synthesizing, or evaluating. As Stanny (2016) pointed out after examining action verbs in various lists based on Bloom's Taxonomy, intended to facilitate writing learning outcomes, a consideration of only the action verb to operationalize the nature of cognitive processing expected of students is insufficient because "independent of context, many words have several meanings, which contributes to ambiguity about the level of cognitive skill intended" (p. 8). Stanny (2016) argued that instead of relying merely on verbs, which are likely to be variously categorized across lists, the context surrounding the terms used to describe the nature of learning goals must also be considered. As such, when creating

and evaluating the opportunities that students are provided to demonstrate their understanding or interpretation, the goals for learning must be stated in a manner that describes the nature of the cognitive activity expected that is aligned with the conditions set for learning.

Opportunities for students to support their understanding or interpretation of information with evidence

Setting conditions that foster academic rigor to facilitate learning provides students opportunities to shift beyond merely relying on the teacher's word as an authority figure to becoming owners of the information as it becomes increasingly interconnected with their other knowledge and is supported with evidence. The learning context should include the resources students need to locate and utilize evidence in support of their arguments (i.e., cultural tools referenced by Whitaker, 2016). The type of evidence students may use to support their interpretations may involve less complex arguments such as citing a rule to more complex rationale such as deriving conclusions from multiple sources or making inferences to other contexts. As learners craft their own understandings, the interpretations and evidence they provide should be based in reality and be defensible, though this does not imply that the rationale has to be "right" (i.e., closed ended or completely consistent with the teacher's interpretation). As learning advances, students should be expected to provide increasingly sophisticated evidence to support their arguments as they engage in more complex cognitive processing of information.

Conclusion

The proposed definition of academic rigor accommodates research supporting the efficacy of teaching techniques on student learning from a variety of disciplines. It does not prescribe specific techniques as it is inclusive of practices that are supported by research to document their efficacy, and this definition accommodates new research on practices yet unstudied. As such, educators have the flexibility to utilize teaching practices that suit them that are supported by research evidence without limiting faculty members to particular techniques. This perspective acknowledges that not all techniques are equally effective at promoting student learning and calls for research to enable educators to gauge efficacy of techniques to best facilitate student learning.

References

Arum, R., & Roksa, J. (2011). *Academically adrift: Limited learning on college campuses*. Chicago, IL: University of Chicago Press.

Arum, R., & Roksa, J. (2014). *Aspiring adults adrift: Tentative transitions of college graduates*. Chicago, IL: University of Chicago Press.

Bjork, E. L., & Bjork, R. A. (2011). Making things hard on yourself, but in a good way: Creating desirable difficulties to enhance learning. In M. A. Gernsbacher, R. W. Pew, L. M. Hough, & J. R. Pomerantz (Eds.) *Psychology and the real world: Essays illustrating fundamental contributions to society* (pp. 56-64). New York, NY: Worth.

Blaich, C., & Wise, K., (2011, January). From gathering to using assessment results: Lessons from the Wabash National Study. (Occasional Paper #8). Urbana, IL: University of Illinois and Indiana University, National Institute for Learning Outcomes Assessment. Retrieved from http://www.learningoutcomeassessment.org/documents/wabash_001.pdf

Chen, J. C. (2014). Teaching nontraditional adult students: Adult learning theories in practice. *Teaching in Higher Education*, 19(4), 406-418. doi: 10.1080/13562517.2013.860101

Donovan, J. J., & Radosevich, D. J. (1999). A meta-analytic review of the distribution of practice effect: Now you see it, now you don't. *Journal of Applied Psychology*, 84(5), 795-805.

Draeger, J., del Prado Hill P., Hunter, L. R., & Mahler, R. (2013). The anatomy of academic rigor: The story of one institutional journey. *Innovative Higher Education*, 38, 267-279.

Draeger, J., del Prado Hill, P., & Mahler, R. (2015). Developing a student conception of academic rigor. *Innovative Higher Education*, 40(3), 215-228. doi: 10.1007/s1075 5-014-9308-1

Francis, C. (2018). Academic rigor in the college classroom: Two federal commissions strive to define rigor in the past 70 years. *New Directions for Higher Education*, 181, 25-34. doi: 10.1002/he.20268

Graham, C., & Essex, C. (2001). Defining and ensuring academic rigor in online and on-campus courses: Instructor perspectives. Annual Proceedings National Convention of the Association for Educational Communications and Technology, 1-2, 330-337.

Harding, L. M. (2018). Students of a feather "flocked" together: A group assignment method for reducing free-riding and improving group and individual learning outcomes. *Journal of Marketing Education*, 40(2), 117-127. doi: 10.1177/0273475317708588

Hartley, M., & Morphew, C. C. (2008). What's being sold and to what end? A content analysis of college viewbooks. *Journal of Higher Education*, 79(6), 671-691.

Hathcoat, J. D., Sundre, D. L., & Johnston, M. M. (2015). Assessing college students' quantitative and scientific reasoning: The James Madison University story. *Numeracy*, 8(1), Article 2. doi: http://dx.doi.org/10.5038/1936-4660.8.1.2 Retrieved from https://scholarcommons.usf.edu/numeracy/vol8/iss1/art2/

Hechinger Institute. (2009). Understanding and reporting on academic rigor. Retrieved from http://hechinger.tc.columbia.edu/primers/Hechinger_Institute_Rigor_Primer.pdf

Hutchings, P., Huber, M. T., & Ciccone, A. (2011). *The scholarship of teaching and learning reconsidered: Institutional integration and impact*. San Francisco, CA: Jossey-Bass.

Jaschik, S., & Lederman, D. (2018). 2018 survey of community college presidents: A study by *Inside Higher Ed* and Gallup. Retrieved from https://www.insidehighered.com/booklet/2018-survey-community-college-presidents

Keller, C. M. (2018). Reframing rigor: Implication for institutional practice and policy. *New Directions for Higher Education*, 181, 89-96. Retrieved from https://onlinelibrary.wiley.com/doi/full/10.1002/he.20273

Kornell, N., & Bjork, R. A. (2008). Learning concepts and categories: Is spacing the "enemy of induction"? *Psychological Science*, 19(6), 585-592.

Kornell, N., & Bjork, R. A. (2009). A stability bias in human memory: Overestimating remembering and underestimating learning. *Journal of Experimental Psychology: General*, 138(4), 449-468.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, 77(6), 1121-1134.

Labaree, D. F. (1997). Public goods, private goods: The American struggle over educational goals. *American Educational Research Journal*, 34(1), 39-81.

Mathers, C. E., Finney, S. J., & Hathcoat, J. D. (2018). Student learning in higher education: A longitudinal analysis and faculty discussion. *Assessment & Evaluation in Higher Education*, 43(8), 1211-1227.

Morphew, C. C., & Hartley, M. (2006). Mission statements: A thematic analysis of rhetoric across institutional type. *Journal of Higher Education*, 77(3), 456-471.

Pleitz, J. D., MacDougall, A. E., Terry, R. A., Buckley, M. R., & Campbell, N. J. (2015). Great expectations: Examining the discrepancy between expectations and experiences on college student retention. *Journal of College Student Retention: Research, Theory & Practice*, 17(1), 88-104.

Roediger, H. L., & Karpicke, J. D. (2006). The power of testing memory: Basic research and implications for educational practice. *Perspectives on Psychological Science*, 1, 181-210. doi: 10.1111/j.1745-6916.2006.00012.x

Roohr, K. C., Liu, H., & Liu, O. L. (2017). Investigating student learning gains in college: A longitudinal study. *Studies in Higher Education*, 42(12), 2284-2300. doi: 10.1080/03075079.2016.1143925

Ryan, J. J., Anderson, J. A., & Birchler, A. B. (1980). Student evaluation: The faculty responds. *Research in Higher Education*, 12(4), 317-333.

Saichaie, K., & Morphew, C. C. (2014). What college and university websites reveal about the purposes of higher education. *Journal of Higher Education*, 85(4), 499-530.doi: 10.1353/jhe.2014.0024

Schnee, E. (2008). "In the real world no one drops their standards for you": Academic rigor in a college worker education program. *Equity & Excellence in Education*, 41(1), 62-80. doi: 10.1080/10665680701764502

Schutz, K. R., Drake, B. M., & Lessner, J. (2013). Do community college full-time and adjunct faculties differ in their perceptions of rigor in assigning grades? *American Journal of Educational Studies*, 6(2), 59-77.

Smith, S. M., & Vela, E. (2001). Environmental context-dependent memory: A review and meta-analysis. *Psychonomic Bulletin & Review*, 8(2), 203-220.

Stanny, C. J. (2016). Reevaluating Bloom's Taxonomy: What measurable verbs can and cannot say about student learning. *Education Sciences*, 6(37), 1-12. doi: 10.3390/edusci6040037

Strada Education Network and Gallup (2018, January). Why higher ed? Top reasons U.S. consumers choose their educational pathways. Retrieved from https://news.gallup.com/reports/226457/why-higher-ed.aspx

Taylor, K., & Rohrer, D. (2010). The effects of interleaved practice. *Applied Cognitive Psychology*, 24, 837-848.

Whitaker, M. (2016). (Re)defining academic rigor: From theory to praxis in college classrooms. *Currents in Teaching & Learning*, 8(1), 4-17.

Wraga, W. G. (2010). What's the problem with a "rigorous academic curriculum"? Paper presented at the meeting of the Society of Professors of Education/American Educational Research Association, Denver, Colorado. Retrieved from https://eric.ed.gov/?id=ED509394

Yan, V. X., Thai, K. P., & Bjork, R. A. (2014). Habits and beliefs that guide self-regulated learning: Do they vary with mindset? *Journal of Applied Research in Memory and Cognition*, 3, 140-152. doi: 10.1016/j.jarmac.2014.04.003