

Racial Inequality in Critical Thinking Skills: The Role of Academic and Diversity Experiences

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Abstract While racial inequalities in college entry and completion are well documented, much less is known about racial disparities in the development of general collegiate skills, such as critical thinking. Using data from the Wabash National Study of Liberal Arts Education, we find substantial inequality in the development of critical thinking skills over four years of college between African American and White students. The results indicate that these inequities are not related to students' academic experiences in college but are substantially related to their experiences with diversity. These findings have important

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implications for understanding racial inequality in higher education and considering strategies for addressing observed disparities.

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Over the course of the 20th century, higher education policy and practice focused on increasing access, and massive expansion led by the public sector provided unprecedented opportunities for students to enter colleges and universities (Hout 1996). As more students entered college, academic and policy attention began to shift toward completion (Goldrick-Rab and Roksa 2008). At the beginning of the 21st century, a new set of concerns gained increasing visibility: learning outcomes. Placed in the public spotlight by *A Test of Leadership*, a report released by the U.S. Department of Education in (2006), the question about whether and how much students are learning in college has become a prominent component of both academic and policy discourse.

Research on racial inequalities in higher education follows these broader trends, dedicating substantial attention to access, and more recently, completion. Prior research provides ample evidence regarding inequalities in college entry and degree completion across different racial groups (see reviews in Deil-Amen and Lopez-Turley 2007; Grodsky and Felts 2009). Disparities in learning outcomes in higher education, however, have garnered much less attention. Only a few studies have examined racial inequalities in critical thinking skills using longitudinal designs that follow students as they progress through college. Those studies have reported substantial inequity in the development of critical thinking skills between African American and White students (e.g., Arum and Roksa 2011; Flowers and Pascarella 2003). While noting the existence of inequality, these studies do not explicate whether and how specific college experiences contribute to the observed disparities.

We aim to fill this gap in the literature by identifying specific aspects of the college experience that may contribute to racial disparities in the development of critical thinking skills during college. We approach this inquiry from the stratification perspective, embedded in the literature on how college affects students. This approach means that we control for a range of factors preceding college entry and focus on understanding how students' college experiences contribute to inequality. In this context, inequality is typically understood to emerge because (a) different groups of students have more or less exposure to various experiences or (b) some groups benefit more from positive experiences (or are hindered less by negative ones). We thus examine how the relationship between race and critical thinking may be mediated (differential distribution) or moderated (differential effects) by students' experiences.

The outcome of interest is the development of critical thinking skills over four years of college. Notably, we are not interested in whether different groups of students score differently on an indicator of critical thinking at a specific point in time. Instead, we estimate students' performance on a measure of critical thinking at the end of college while controlling for their performance on the same measure at college entry—in effect thus, we are studying growth or the development of critical thinking during college. The principle of equity would imply that all students should experience the same gains in critical thinking over time. Finding that they do not draws attention to students' college experiences as an avenue for explaining how college contributes to racial inequality.

More specifically, we rely on recent longitudinal data from the Wabash National Study of Liberal Arts Education to consider how students' academic experiences and their experiences with diversity are related to racial inequality in the development of critical thinking skills during college. We find that inequality in the development of critical thinking skills between African American and White students is not related to students' academic experiences in college, but is substantially related to their experiences with diversity. In the conclusion, we elaborate on the implications of these findings for the models of college student development as well as for policies and practices aimed at reducing observed disparities.

Literature Review

Higher education scholars have examined racial differences in a range of college experiences and outcomes. For example, prior studies have considered the relationship between race and student engagement (Fischer 2007; Greene et al. 2008; Kuh et al. 2008; Lundberg 2012), student satisfaction (Fischer 2007), educational aspirations (Pascarella et al. 2004), academic achievement (Fischer 2007; Greene et al. 2008; Strayhorn 2010), and persistence and completion (Deil-Amen and Lopez-Turley 2007; Grodsky and Felts 2009). Few studies, however, have examined racial inequality in the development of critical thinking skills.¹

In the mid-1990s, the National Study of Student Learning led by Ernest Pascarella and Patrick Terenzini followed a sample of students through college and assessed a range of different skills, including critical thinking. The results indicated that African American students experienced lower gains in critical thinking skills between the freshman and junior year than their White peers (Flowers and Pascarella 2003). More recent research, focusing on the first two years of college, has similarly reported that African American students gain less on a measure of critical thinking, complex reasoning, and writing than White students (Arum and Roksa 2011). In addition, a recent cross-sectional study by Kugelmass and Ready (2011) revealed that African American and Hispanic students had lower levels of general collegiate skills, assessed using the CLA, compared to their White peers.

While these studies reveal substantial inequality in the development of critical thinking skills during college, they provide limited understanding of how different college experiences may contribute to these patterns. Arum and Roksa's (2011) work focuses primarily on pre-college characteristics and dedicates limited attention to college experiences. Kugelmass and Ready's (2011) study does not follow students longitudinally, and it emphasizes the role of institutional characteristics rather than students' college experiences. Flowers and Pascarella (2003) control for a range of college experiences in order to report the net effects of race, but do not aim to understand how different college

¹ Critical thinking is a term that is often used but rarely clearly defined. In essence, it aims to reflect one's ability to analyze, synthesize, and/or evaluate information. To date, two standardized assessments of critical thinking most commonly used in published research are the Critical Thinking Test from the Collegiate Assessment of Academic Proficiency (CAAP) developed by the ACT and the collegiate learning assessment (CLA) developed by the Council for Aid to Education. CAAP includes three components: analyzing, evaluating, and extending an argument. CLA similarly includes an analysis and critique of an argument as well as critical reading and evaluation. Although CAAP and CLA are designed very differently, they produce similar results in terms of the overall gains in student performance (Pascarella et al. 2011a). Moreover, a recent validity study of three different tests—CAAP, CLA and MAPP (Measure of Academic Proficiency and Progress, developed by the ETS)—supported the measures' construct validity (Klein et al. 2009).

experiences may contribute to observed patterns. In other words, they do not add experiences sequentially to the models in order to illuminate whether and how much different aspects of the college experience may contribute to racial inequality. Furthermore, Flowers and Pascarella's (2003) study relies on an older cohort of students, and it does not follow students through all four years of college. In the current study, we rely on three recent cohorts of students followed from their freshman to their senior year of college and examine the extent to which students' academic and diversity experiences contribute to racial inequality in the development of critical thinking skills during college.

Academic Experiences

Since the seminal work by Chickering and Gamson (1987, 1991), who synthesized good practices in undergraduate education, scholars have paid close attention to students' academic experiences, including their time on task, quality of instruction, and interaction with instructors and other students (for reviews, see Pascarella and Terenzini 1991, 2005). Although an extensive body of research on good practices exists, a much smaller number of studies has explored the relationship between college experiences and a direct measure of critical thinking, especially using longitudinal study designs where students are followed as they progress through college (e.g., Arum and Roksa 2011; Cruce et al. 2006; Pascarella et al. 1996, 2013; Terenzini et al. 1995).

While focusing on different dimensions of students' academic experiences, these studies point to the importance of considering at least two specific factors: students' time on task (i.e., study time) and classroom experiences, with a particular emphasis on clear and organized instruction. Using data from the National Study of Student Learning, Pascarella and colleagues (Pascarella et al. 1996) found that students who reported that they received clear and organized instruction during college had larger gains on measures of mathematics, reading comprehension, and critical thinking. More recent data from the Wabash National Study similarly revealed that clear and organized instruction enhanced the use of deep approaches to learning, which was associated with gains in critical thinking over four years of college (e.g., Pascarella et al. 2013). In addition, Cruce and colleagues (Cruce et al. 2006) reported that a composite indicator of good practices, which included different aspects of clear and organized instruction, was related to the development of critical thinking skills during the first year of college.

Clear and organized instruction is emerging as a relevant factor not only in the studies of critical thinking, but in a broader literature examining a range of different academic outcomes in college. Bray et al. (2004), for example, found that instructional clarity and organization had a significant positive influence on gains in reading comprehension for college students. Beyond the development of specific skills during college, teaching organization and clarity in the first year also significantly predicted students' intention to re-enroll for a second year of college (Pascarella et al. 2011b). Indeed, a summary of results offered by the Center of Inquiry at Wabash College indicates that clear and organized instruction is related to a range of outcomes, from critical thinking to academic motivation, GPA and persistence, leading the authors to conclude that "Clarity and organization, and the lack thereof, has serious consequences for students" (Blaich and Wise 2014).

Another aspect of the academic experience that is positively related to a range of different outcomes, from GPA to students' perceptions of their skills in both general and subject-specific domains, is time on task, or more specifically, the amount of time students spend studying (Astin 1993). Several studies have reported a positive relationship between

students' academic time use and academic performance, as measured by GPA (e.g., Lahmers and Zulauf 2000; Plant et al. 2005). Similarly, using data from the National Survey of Student Engagement (NSSE), Kuh and colleagues (Kuh et al. 2008) reported that time spent on academically purposeful activities had a positive effect on first year GPA and persistence to the second year of college.

Studies focusing specifically on critical thinking similarly note that time spent studying is related to students' gains in these skills. In a longitudinal study examining how different factors are related to the development of critical thinking skills during the first year of college, Terenzini et al. (1995) found that the number of hours students spent studying was positively associated with gains in critical thinking. A more recent study following students through the first two years of college also reported that the amount of time students spent studying was related to their gains on a test of critical thinking Arum and Roksa (2011). Although not based on a longitudinal design Carini et al. (2006), reported that time spent engaged in academically purposeful activities was modestly, but positively, associated with critical thinking as well as college grades.

Diversity Experiences

A related, but often distinct, body of research has suggested that students' experiences with diversity may be associated with critical thinking, a dimension that is especially important to consider given our attention to racial disparities. With increasingly diversified college campuses, diversity experiences have emerged as a critical component of higher education. Bowman (2010) conducted a meta-analysis of studies examining the relationship between diversity experiences and cognitive development during college. He concluded that while structural diversity (i.e., representation of traditionally under-represented racial/ethnic groups of students on campus) is necessary, it is not sufficient—sustained benefits of diversity come from interactions with diverse peers, especially in the informal contexts (i.e., outside of the classroom).

Frequent interaction with diverse peers is positively associated with students' intellectual engagement, leadership skills and psychological well-being (Bowman 2013), cultural or diversity-related outcomes (antonio 2001; Bowman 2013), and civic engagement (Bowman et al. 2011). Moreover, studies find that cross-racial interactions are positively associated with students' social and intellectual development (Chang et al. 2004; Gurin et al. 2002). Focusing on academic outcomes, scholars have examined the relationship between diversity experiences and students' intellectual engagement (e.g., Bowman 2013; Gurin et al. 2002), self-reported gains in generic collegiate skills such as critical thinking and problem solving (Chang et al. 2004; Hurtado 2001; Kim 2002), or self-reported intellectual development (Chang et al. 2004; Hu and Kuh 2003; Umbach and Kuh 2006). To explain the relationship between diversity experiences and cognitive development, Gurin and colleagues (Gurin et al. 2002) proposed a theoretical framework positing that interactions with diverse peers present occasions for discontinuity and discrepancy, which fosters cognitive growth. Bowman and Brandenberger (2012) confirmed this underlying mechanism in a study of students' orientation toward equality and social responsibility. They found that diversity experiences were related to experiencing the unexpected, which in turn was related to belief change.

Although the literature on diversity experiences is extensive, very few studies have examined the relationship between interactional diversity—i.e., interaction with diverse peers—and critical thinking, measured using a standardized measure. Additionally, studies that have assessed this outcome have produced mixed results. Early research based on the

National Study of Student Learning reported that interactions with diverse peers were related to gains on a standardized measure of critical thinking (Pascarella et al. 2001). More recent studies have reported no benefits of diversity experiences for critical thinking assessed at one point in time (Hurtado 2005b) or over the first year of college (Loes et al. 2012). At the same time, at least one recent study reported a statistically significant relationship between diversity interactions and gains in critical thinking over four years of college (Pascarella et al. 2014).

The vast majority of research examining diversity experiences and college student development has focused on positive or neutral experiences. More recently, however, a few studies have highlighted the importance of considering the influence of negative diversity interactions (e.g., Roksa et al. [In press](#)). These studies draw on insights from the literature on college racial climates and students' experiences of prejudice and discrimination (e.g., Cabrera and Nora 1994; Cabrera et al. 1999). Considering students' self-reported problem-solving and complex thinking skills, Hurtado (2005a) found a positive association with both positive and negative diversity experiences. At the same time, Nelson Laird (2005) reported that negative diversity experiences, but not positive ones, were related to the overall disposition to think critically. This latter finding is consistent with a cross-sectional study of critical thinking skills using the California Critical Thinking Skills Test, which found that negative (but not positive) diversity interactions were related to this outcome (Hurtado 2005b).

The Present Study

The goal of this study is to explore how different college experiences—including academic experiences and experiences with diversity—contribute to inequality in the development of critical thinking skills during college. Several previous studies have reported inequality in the development of critical thinking skills between African American and White students. While documenting the existence of inequalities is valuable, addressing them requires an understanding of the various factors that may contribute to the observed disparities.

Inequality is commonly associated with two different processes that can be examined using quantitative methods—differential distribution (mediation) and differential effects (moderation/conditional effects). The review of the literature identified several specific variables that are related to the development of critical thinking skills, measured using a standardized indicator. This helped us narrow the vast array of college experiences into two overall categories and several specific measures. The first two research questions thus are:

- (a) Do academic experiences, specifically time spent studying and exposure to clear and organized instruction, contribute to racial inequality in the development of critical thinking skills during college?
- (b) Do diversity experiences, including both positive and negative interactions, contribute to racial inequality in the development of critical thinking skills during college?

Figure 1 presents the logic of our approach graphically. If academic and diversity experiences serve as mediators, then (a) race will be related to those experiences (or in other words, academic and diversity experiences will be unequally distributed), and (b) those experiences will in turn be related to the development of critical thinking skills. If the mediation is complete, we will no longer observe the relationship between race and the development of critical thinking skills (represented by the dashed line). If the mediation is partial, there will still be a relationship between race and the development of critical thinking skills, but that relationship will be attenuated by including academic and diversity experiences in the model.

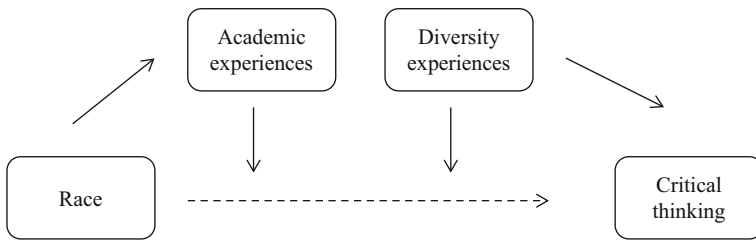


Fig. 1 Mediation and moderation effects examined in the study

In addition to the mean differences between groups, inequality may result from differential benefits. In other words, certain groups may benefit more from positive experiences or be hindered less by negative ones. To consider this possibility, we examine whether the effects of academic and diversity experiences are moderated by race. Our final research question thus is:

- (c) Is the relationship between academic and diversity experiences and critical thinking moderated by race?

To address this question we include interaction terms between race and academic and diversity experiences in the fully specified model. In Fig. 1, the possibility of moderating (i.e., conditional) effects is represented by the smaller downward arrows pointing from the academic and diversity experiences to the link between race and critical thinking skills.

Our analysis is guided by the conceptual models offered by Pascarella (1985), Astin (1993), and Tinto (1993). Using these conceptual models, researchers have been cognizant of the importance of considering at least three different sets of factors when studying how college affects students: what students bring to college, what they do during college, and what institutional contexts they are embedded within. Following these frameworks, we take advantage of the longitudinal design of the Wabash National Study (WNS) to control for background characteristics and the relevant dimensions of the institutional environment. While controlling for those factors, we focus on students' college experiences in order to illuminate the extent to which they may contribute to racial disparities in the development of critical thinking skills.

Methods

To address our research questions, we relied on data from the Wabash National Study of Liberal Arts Education (WNS), a longitudinal, multi-institutional study of college experiences and outcomes. The WNS includes data from students attending a range of colleges and universities throughout the United States. WNS institutions were selected to represent the diverse characteristics of American higher education institutions including institutional type, size, selectivity, and location. Across the three waves, 43 different four-year institutions participated in the study: 28 are liberal arts colleges, six are research universities, and nine are regional institutions².

² Three institutions participated in multiple waves of the study. A dummy variable for those institutions is included in analysis.

First-year, full-time students were invited to participate in a longitudinal study of undergraduate experiences. The student sample was selected in two ways. For larger institutions, it included a random sample of students at the institution. For smaller institutions, it included the entire incoming first-year class. In the fall of their first year of college, students completed a survey including demographic characteristics, family background, high school experiences, and college plans. At that time, they also completed several assessments, including a test of critical thinking.

The same students were followed through the end of their fourth year in college and surveyed two more times—in the spring of their first year and spring of their fourth year. In the follow-up surveys, students were asked a range of questions about their experiences in college, including their academic experiences and experiences with diversity. Moreover, students completed a post-test of the assessments administered in the first year, including critical thinking. This is one of the unique strengths of the WNS study—it presents a longitudinal portrait of students as they progress through college, with the key outcome of interest measured at both the beginning of the first year and the end of the fourth year. All estimates are thus essentially predicting growth—i.e., predicting students' fourth year critical thinking, while controlling for the same indicator at the start of college.

The WNS includes three cohorts of students who were freshmen in 2006, 2007, and 2008. Due to the wealth of data collected in WNS, and the time demands that placed on students, some of the instruments, including the critical thinking assessment, were administered only to approximately half of the sample. The sample in this study includes students who were surveyed in both the first and fourth years of college and who completed critical thinking assessments at both time points, which leads to our analytical sample of 2,636 students.

Since WNS sampled students within participating institutions, students are clustered within schools. The interclass correlation coefficient (ICC), or the proportion of the variance reflecting between-institution differences, is 28 % for the fourth-year critical thinking scores. In the presented models, we controlled for the outcome of interest at the start of college—in other words, we estimated critical thinking skills at the end of the fourth year while controlling for critical thinking skills at the beginning of the first year, in essence producing estimates of growth. The ICC for the growth model (i.e., controlling for critical thinking in the first year) is 12 %. Although some authors recommend using HLM when ICC is >5 % (Heck and Thomas 2008), others do not make any recommendations regarding a cutoff (Raudenbush and Bryk 2002). Since a substantial, and statistically significant, amount of variance was found across institutions, we used hierarchical linear models (HLM) as our analytic strategy.

Level-1 model can be represented by the following equation:

$$Y_{ij} = \beta_{0j} + \beta_{1j} \text{AFRICAN AMERICAN}_{ij} + \beta_{2j} \text{HISPANIC}_{ij} + \beta_{3j} \text{ASIAN}_{ij} \\ + \beta_{4-5j} \text{ACADEMIC EXPERIENCES}_{ij} + \beta_{6-7j} \text{DIVERSITY EXPERIENCES}_{ij} \\ + \beta_{kj} \delta_{ij} + r_{ij}$$

where Y_{ij} is a score on a critical thinking assessment for student i in school j ; $\text{AFRICAN AMERICAN}_{ij}$, HISPANIC_{ij} , and ASIAN_{ij} represent dummy variables for different racial groups (with White serving as a reference); $\text{ACADEMIC EXPERIENCES}_{ij}$ includes measures of time spent studying and teaching clarity and organization; $\text{DIVERSITY EXPERIENCES}_{ij}$ includes indicators of positive and negative diversity interactions; and δ_{ij} is a vector of individual-level control variables.

Level-2 model includes two institutional-level controls:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\text{STRUCTURAL DIVERSITY}_j \\ + \gamma_{02}\text{INSTITUTIONAL SELECTIVITY}_j + u_{0j}$$

Variables

The dependent variable examined in this study is critical thinking. Critical thinking is assessed using the Critical Thinking Test from the Collegiate Assessment of Academic Proficiency (CAAP) developed by the American College Testing Program (ACT). This is a 40-minute, 32-item instrument designed to measure students' ability to clarify, analyze, evaluate, and extend arguments. The test consists of four passages in a variety of formats (e.g., case studies, debates, dialogues, experimental results, statistical arguments, and editorials). Each passage contains a series of arguments that support a general conclusion and a set of multiple-choice test items. Essentially, the test requires students to read passages commonly found in higher education curricula. After reading the passages, students are required to choose a multiple-choice response that best supports a general conclusion about the series of arguments presented in the passage. The test is divided into three sections: analysis of elements of an argument (representing the highest proportion of the test), evaluation of an argument, and extension of an argument. The internal consistency reliabilities for the CAAP critical thinking test range between 0.81 and 0.82 (ACT 1991). CAAP correlates 0.75 with the Watson–Glaser Critical Thinking Appraisal (Pascarella et al. 1995).

The key independent variable of interest is race, which is divided into four categories: African American, Hispanic, Asian, and White (reference). Our key explanatory measures include: a) academic experiences, and b) diversity experiences. Based on prior research, we identified two indicators of academic experiences that are most consistently related to cognitive development: hours spent studying and teaching clarity and organization. The latter is a 10-item scale with individual items reported in Table 1 (alpha = 0.89). This scale has vetted reliability and validity and was shown to be related to growth in general cognitive skills during college (Pascarella et al. 1996; Pascarella et al. 2013).

While prior research has typically focused on positive diversity experiences, several recent studies have drawn attention to negative diversity experiences and noted that the two types of experiences are correlated (Bowman 2012). Following the definitions outlined in Gurin et al. (2002), positive diversity interactions include meaningful discussions about diversity and sharing of personal feelings and problems. The scale includes three items listed in Table 1 (alpha = 0.83). Negative diversity interactions reflect students' negative experiences with diversity from experiencing prejudice and discrimination to experiencing hurtful and tense interactions. The scale includes four items listed in Table 1 (alpha = 0.88).

In addition to these key variables of interest, all analyses control for students' performance on the critical thinking test at college entry, and thus, following convention in the literature, we refer to our estimates as growth/development. We also control for students' need for cognition at college entry, capturing not only their performance on a test of critical thinking but also their attitudes toward challenging cognitive activities. Need for cognition is an 18-item scale measuring the degree to which one enjoys effortful cognitive activities (Cacioppo et al. 1984).

In addition, all analyses control for a range of background characteristics: gender (0 = female, 1 = male), age, parental education (highest year of education completed by

Table 1 Definitions of the key independent variables

Items included in the scale	Alpha
Teaching clarity and organization	0.89
These ten questions ask students how often they have experienced faculty who: gave clear explanations; made good use of examples and illustrations to explain difficult points; effectively reviewed and summarized the material; interpreted abstract ideas and theories clearly; gave assignments that helped in learning the course material; presented material in a well-organized way; came to class well prepared; used class time effectively; clearly explained course goals and requirements; and had a good command of what they were teaching. Original questions were asked on a 5-point scale ranging from very often to never.	
Negative diversity interactions	0.88
These four questions ask students how often they have had specific types of interactions with diverse students (e.g., students differing from them in race, national origin, values, religion, political views) while attending their college, including: felt silenced by prejudice and discrimination from sharing your own experiences; had hurtful, unresolved interactions; had tense, somewhat hostile interactions; and felt insulted or threatened based on my race, national origin, values, or religion. Original questions were asked on a 5-point scale ranging from very often to never.	
Positive diversity interactions	0.83
These three questions ask students how often they have had specific types of interactions with diverse students (e.g., students differing from them in race, national origin, values, religion, political views) while attending their college, including: had meaningful and honest discussions about issues related to social justice; had discussions regarding inter-group relations; and shared personal feelings and problems. Original questions were asked on a 5-point scale ranging from very often to never.	

either parent), and educational expectations (i.e., whether students expected to complete more than a bachelor' degree). Since the sample included three cohorts of students, we control for cohort (dummy variables for the 2007 and 2008 cohorts, with the 2006 cohort serving as a reference). And since some of the schools participated in the study multiple times, we include a dummy variable reflecting multi-year participation (0 = participated in one year, 1 = participated in multiple years).

Finally, although we have a relatively small number of institutions, which limits our ability to effectively estimate level-2 predictors, we include school-level characteristics of most relevance to our research questions. First, given our consideration of diversity experiences, we control for structural diversity—the percentage of students of color at each institution. In addition, we control for institutional selectivity—the average ACT score of the incoming freshman class. Prior literature regarding institutional characteristics, including selectivity, is mixed. Some studies have suggested that selectivity is related to gains in critical thinking (Roksa and Arum 2015; Kugelmass and Ready 2011) but others have not found much of a relationship between selectivity and good educational practices in higher education (e.g., Kuh and Pascarella 2004; Pascarella et al. 2006).

Limitations

One of the key limitations of this study is the small number of cases available across different racial groups. Prior research using the Wabash National Study data has typically combined all non-White racial groups into one category. That is helpful in terms of increasing power for statistical analyses, but not appropriate for our study, which aims to

explain inequality in critical thinking. Descriptive patterns indicate that the development of critical thinking skills during college differs across racial groups. Table 2 further shows that the patterns across models vary across groups. This necessitates considering different racial groups separately.

Without the ability to combine cases, we are left with relatively small samples for specific racial groups and may not have enough power to detect effects, particularly when estimating interactions. The sample includes 176 African American, 132 Hispanic, and 166 Asian students.³ Future research with larger samples is needed to further explore the questions raised in this study. Nonetheless, given the uniqueness of the Wabash National Study, and the absence of either indicators of critical thinking or detailed information on instructional and diversity experiences in other datasets, these results provide an important starting point.

In addition, the WNS is not a nationally representative sample. The WNS includes a range of four-year institutions that vary along a range of different dimensions, but the institutions are overall relatively selective and liberal arts schools are over-represented within the institutional sample. The results can thus be generalized to the sample examined, but not necessarily to the population as a whole. In the current sample, the role of institutions is not pronounced, with neither of the institutional characteristics considered being statistically significant. Other existing datasets that include a large number of institutions do not include either a direct measure of critical thinking or a robust set of measures capturing students' college experiences. WNS is thus the only dataset available to address our research questions. Future data collection efforts that incorporate the key indicators currently available in WNS while also including a large number of institutions will be valuable in replicating presented results.

Finally, there is a long history of debate in the U.S. about what standardized tests measure and whether they are biased against certain groups, such as African Americans. In *Inequality by Design*, Fischer and colleagues (Fischer et al. 1996) convincingly argued that student performance on standardized tests is affected by learning opportunities afforded to different groups. Indeed, the vast array of studies emerging from the Wabash National Study indicate that critical thinking skills are related to students' experiences inside and outside of the classroom.⁴ Critical thinking is thus sensitive to opportunities students have in colleges and universities, which is further corroborated by our analyses.

With respect to test bias, Grodsky and colleagues (Grodsky et al. 2008) present a compelling analysis of the debates regarding bias in standardized testing and the challenges involved in proving or negating the presence of bias. While the testing agencies conduct multiple assessments to guard against bias, critiques of the tests, most often the SAT, have continued. Some scholars have proposed strategies to adjust for bias (e.g., Freedle 2003), although others have shown that those corrections do not necessarily reduce inequality in performance (Dorans 2004). Resolving this debate is beyond the scope of the present study. At the same time, we acknowledge that the measure used in this study, along with all standardized tests, has

³ Although the number of students in different racial categories is low, it is important to note that the sample examined in this study includes students who entered higher education through four-year institutions and persisted through four years of college. Authors' calculations indicate that the proportion of African American students in the WNS sample is similar to a comparable sample in the Education Longitudinal Study (ELS), which is a nationally representative sample. The proportion of Asian students is lower in the WNS sample and the comparison cannot be made for Hispanic students because ELS uses different racial/ethnic categories.

⁴ For a list of studies using the Wabash National Study data, see: <http://www.liberalarts.wabash.edu/research-and-publications/>.

Table 2 HLM regression models predicting senior year critical thinking skills

	Model 1	Model 2	Model 3
Race [reference: White]			
African American	−0.201** (0.066)	−0.204* (0.066)	−0.154* (0.066)
Hispanic	−0.102^ (0.061)	−0.104^ (0.061)	−0.087 (0.061)
Asian	−0.008 (0.056)	−0.017 (0.056)	0.006 (0.056)
Academic experiences			
Teaching clarity/organization		0.061** (0.013)	0.046** (0.014)
Hours studying		0.002 (0.002)	0.003^ (0.002)
Diversity experiences			
Positive experiences			0.010 (0.015)
Negative experiences			−0.132** (0.019)
Controls			
Critical thinking at entry	0.600** (0.017)	0.595** (0.017)	0.587** (0.016)
Need for cognition at entry	0.063** (0.014)	0.057** (0.014)	0.062** (0.014)
Male	0.032 (0.029)	0.048^ (0.029)	0.063* (0.029)
Age	−0.014 (0.012)	−0.014 (0.012)	−0.014 (0.012)
Parental education	0.002 (0.006)	0.001 (0.006)	0.002 (0.006)
Expect more than BA	0.055 (0.036)	0.056 (0.036)	0.054 (0.035)
Cohort [reference: 2006 cohort]			
2007 cohort	−0.155^ (0.083)	−0.154^ (0.082)	−0.144^ (0.081)
2008 cohort	−0.217** (0.073)	−0.215** (0.073)	−0.199** (0.071)
Multiple cohort	−0.047 (0.158)	−0.058 (0.156)	−0.027 (0.151)
School characteristics			
Selectivity	0.014 (0.013)	0.010 (0.013)	0.011 (0.013)
Structural diversity	−0.256 (0.237)	−0.273 (0.235)	−0.285 (0.228)
Intercept	0.018 (0.444)	0.109 (0.440)	0.208 (0.430)

** $p < 0.01$, * $p < 0.05$, ^ $p < 0.10$. $N = 2,636$

Critical thinking skills are standardized with a mean of zero and standard deviation of one

limitations. While standardized assessments aim to capture complex skills fairly, debates about their ability to do so will inevitably continue in the foreseeable future.

Results

Table 2 presents results from hierarchical linear models (HLM) predicting students' critical thinking skills at the end of their fourth year of college, while controlling for their critical thinking scores at college entry, along with a number of other variables. The first model indicates that there is substantial inequality in the development of critical thinking skills during college between African American and White students. Since the model controls for critical thinking skills at college entry, the coefficient indicates that African American students gain on average 0.20 of a standard deviation less on the critical thinking assessment than White students by the end of college. Net of controls, Hispanic students also gain less on the critical thinking assessment than White students, although this coefficient is much smaller in magnitude and statistically significant only at the 0.10 level.⁵ The difference between Asian and White students is close to zero and not statistically significant.

The remainder of the article explores the extent to which different college experiences may contribute to these inequalities in the development of critical thinking skills during college. Model 2 begins by considering two specific academic experiences: the amount of time students spend studying and teaching clarity and organization. Teaching clarity and organization is significantly related to critical thinking skills. This finding contributes to the small, but growing, body of research suggesting that teaching clarity and organization is an important factor to consider when examining students' cognitive development in college (Pascarella et al. 1996; Pascarella et al. 2013).

The amount of time students spend studying, however, is not statistically significant in Model 2. This measure becomes statistically significant at the 0.10 level in the final model, although even then the magnitude is low. These patterns support those reported by Lahmers and Zulauf (2000) in a study of GPA. They found that study time was positively associated with increased GPA, but that students would need to increase study time significantly to lead to more than a small increase in their overall GPA. In addition, at least one study suggested that different forms of studying—studying alone vs. studying with peers—have distinct effects on critical thinking skills (Arum and Roksa 2011). Our measure does not differentiate between these different forms of studying (students were asked how much time they spent preparing for class), which may contribute to the relatively weak results for study time.

What is particularly notable about findings in Model 2 is that the coefficients for African American and Hispanic students remain essentially identical (i.e., of the same magnitude and statistical significance) after adding academic experiences. These patterns imply that different racial groups have similar experiences of teaching clarity and organization and spend the same amount of time studying. Indeed, supplemental models confirm those patterns. While descriptive results show some differences across racial groups, when we estimated these outcomes in the fourth year of college net of controls, we found no meaningful or statistically significant differences across racial groups (see also Trolian et al. 2014). Given similarity in these measures across different racial groups, academic experiences do not contribute to inequality in the development of critical thinking skills.

⁵ We include 0.10 statistical significance level in the table given the small number of students in different racial groups.

We have focused on these two factors—study time and teaching clarity and organization—as they emerged as most relevant in the prior literature on the relationship between students’ academic experiences and critical thinking skills. As the literature review indicated, while an extensive body of research has examined relationships between different academic experiences and student outcomes, relatively few studies have examined the relationship between academic experiences and critical thinking skills, measured using a direct measure (as opposed to student self-reports). Those that have point to time on task and teaching clarity and organization as the most relevant factors, which is why we focused on them in this study.

In supplemental analyses, we considered a number of other indicators, but they were either not significantly related to critical thinking or did not vary across racial groups and therefore could not contribute to explaining the observed inequalities in critical thinking. To be a mediator, a variable of interest must be both unequally distributed by race and related to the development of critical thinking skills (Baron and Kenny 1986). For example, deep approaches to learning (considering higher order, reflective, and integrative learning) were neither significantly related to critical thinking nor did they differ between African American and White students. College major, on the other hand, was significantly related to critical thinking, but did not vary between African American and White students net of controls, and thus did not contribute to understanding racial inequality in critical thinking. These results imply that academic experiences are not central to understanding racial inequality in the development of critical thinking skills during college.

Finding that academic experiences do not contribute to inequality in the development of critical thinking skills is encouraging, but it raises the question of what might explain the observed patterns between African American and White students. Model 3 considers another dimension that has been highlighted in the literature on college student development and adjustment to college: diversity experiences. As the literature review indicated, while much research has examined the relationship between diversity experiences and student outcomes, only a few studies have considered the relationship between these experiences and critical thinking skills measured using a standardized indicator, and even fewer studies have explored the importance of negative diversity experiences.

Model 3 indicates that positive diversity experiences are not related to critical thinking skills. Negative experiences, on the other hand, have a statistically significant negative relationship to this outcome. Each one point increase in negative diversity experiences (on a Likert scale ranging from never (1) to very often (5)) decreases students’ critical thinking skills on average by 0.13 of a standard deviation, controlling for critical thinking skills at entry and other variables included in Table 2. These findings highlight the value of considering negative diversity experiences, which are rarely examined in the studies of critical thinking.

Moreover, adding diversity experiences to the model decreases the coefficient for African American students (as well as Hispanic students), reducing the relationship between race and critical thinking. Relative to the previous model that does not account for diversity experiences, the coefficient for African American students decreases by 25 % in Model 3. The coefficient for Hispanic students decreases less (by 16 %), but enough to drop below the 0.10 significance level. These patterns indicate that diversity experiences—and in particular negative diversity experiences—are important contributors to inequalities in the development of critical thinking skills during college between different racial groups. This pattern emerges since negative diversity experiences are both consequential for critical thinking skills and vary across racial groups. The difference between African American and White students in negative diversity experiences is half a standard

Table 3 HLM regression models testing interaction terms between college experiences and race (selected results)

	Model 1	Model 2
Academic experiences		
Teaching clarity/organization x African American	−0.026 (0.060)	
Hours studying x African American	0.022 (0.054)	
Diversity experiences		
Positive experiences x African American		−0.087 (0.060)
Negative experiences x African American		0.051 (0.059)

The models include all variables reported in Table 2

None of the interaction terms are statistically significant at $p < 0.10$

deviation—African American students report experiencing negative diversity interactions at a level that is half a standard deviation higher than that reported by their White peers.

Our final research question asks whether the relationship between different academic and diversity experiences and critical thinking skills varies across racial groups. In other words, college experiences may not contribute to racial inequality only due to mean differences; they may also have differential (or conditional) effects for different groups. Indeed, in the review of the vast literature on how college affects students, Pascarella and Terenzini (2005) emphasized the importance of examining conditional effects, namely the way college impacts may vary across students from different backgrounds.

To consider the possibility of conditional effects, we tested interaction terms between different racial groups and academic and diversity experiences. Table 3 reports selected results from those models, presenting only interaction terms (all other variables from Table 2 are included in the models). Model 1 includes interaction terms for academic experiences and Model 2 for diversity experiences to reduce the possibility of multicollinearity. The results remain the same if all interaction terms are entered in the model simultaneously. Table 3 indicates that none of the interaction terms are statistically significant (nor of large magnitude), implying that the effects of academic and diversity experiences on critical thinking are the same for African American and White students. The same results are obtained if models are run separately for the two racial groups. While these results indicate that there are no conditional effects, they need to be interpreted with caution given our small sample size for African American students. Future research, with larger sample sizes, may be better positioned to evaluate the importance of conditional effects, and in particular whether specific college experiences differentially influence critical thinking skills across racial groups.

Conclusion

While ample research has documented inequalities in outcomes such as college access and completion, we focus on the development of critical thinking skills. The importance of critical thinking skills has been broadly endorsed by higher education institutions (Bok 2006) as well as employers (AAC&U 2008; NRC 2012). Moreover, recent research

indicates that general collegiate skills such as critical thinking are related to a range of post-college outcomes, particularly job prospects (Arum and Roksa 2014). Developing critical thinking skills thus constitutes an important outcome of college education.

Only a few prior studies have examined racial inequalities in the development of critical thinking skills using direct measures of those skills. Those studies have revealed inequalities in the development of critical thinking skills between African American and White students. Although documenting inequality, prior studies have not explicated how college experiences may contribute to the observed disparities, which is the goal of the present study. More specifically, we examine how students' academic and diversity experiences contribute to racial inequality in the development of critical thinking skills during college.

Presented findings indicate that academic experiences, and more specifically the amount of time students spend studying and their exposure to clear and organized instruction, do not contribute to racial inequality in the development of critical thinking skills. Although the latter (clear and organized instruction) is related to critical thinking, it is not differentially distributed across racial groups net of controls, and therefore does not contribute to inequality. We also find no statistically significant interactions between race and these academic experiences, although our sample size for African American students is small—we thus may not have adequate power to detect interaction effects.

A subset of diversity experiences, on the other hand, contributes to racial inequality in the development of critical thinking skills. While positive diversity experiences are not related to this outcome, negative experiences are. These findings are consistent with several prior studies noting the importance of negative diversity experiences for developing critical thinking dispositions (e.g., Nelson Laird 2005) and skills (e.g., Hurtado 2005b). We extend these findings by showing that negative diversity experiences explain a substantial portion of the inequality in the development of critical thinking skills between African American and White students. African American students are substantially more likely to be exposed to negative diversity experiences, which contributes to the observed disparities in critical thinking. Similar to our findings regarding academic experiences, we find no statistically significant interactions between race and positive or negative diversity experiences.

Implications for Research

This study demonstrates the value of breaking down the silos separating different lines of inquiry in higher education. Studies of students' cognitive development in college, drawing on frameworks proposed by Astin (1993), Pascarella (1985), and Tinto (1993) have overwhelmingly focused on understanding how different academic and social experiences contribute to cognitive development. This line of research has less often attended to examining racial inequalities in student outcomes.⁶ Moreover, when diversity experiences are considered in this literature, the focus is overwhelmingly on the positive or neutral experiences. In many ways, this literature helps to illuminate the positive and equitable aspects of higher education. Some of our findings support this approach—academic experiences, such as clear and organized instruction, facilitate students' cognitive development, and do so for African American and White students alike.

However, our finding regarding negative diversity experiences presents a much less sanguine picture of higher education. Although all students are affected by negative

⁶ Some studies of cognitive development estimate conditional effects by race. However, that is rarely the focus of their inquiry. The focus is typically on understanding how specific experiences facilitate student development, and conditional effects are reported as a complement to the overall analysis.

diversity experiences (see also Cabrera et al. 1999; Nora and Cabrera 1996), African American students are disproportionately exposed to negative diversity experiences. Inequality thus does not emerge from differential effects but from differential distributions of negative diversity experiences. In other words, while negative diversity experiences have a consistent negative impact on critical thinking of both African American and White students, they are more consequential for the development of critical thinking of African American students because these students encounter more negative diversity experiences than their White peers. Negative diversity experiences are rarely included in the studies of student development as they are primarily the purview of a different research tradition, one focusing on campus racial climates, and in particular students' experiences of prejudice and discrimination (for reviews, see Harper and Hurtado 2007; Hurtado et al. 1998).

Understanding the effects of students' experiences and their consequences for racial inequality requires attention to both dimensions (academic and diversity) and both types of diversity experiences (positive and negative). It is crucial that we recognize areas that produce equitable outcomes as well as those that foster inequality. Without attention to both, studies present an incomplete picture of students' experiences more generally, and racial inequality more specifically. Therefore, we encourage future research examining racial inequality in critical thinking to broaden the scope of inquiry and include a range of different experiences. Instead of siloed investigations of specific experiences, we encourage researchers to collaborate and expand their reach to include the complexity of students' experiences in their investigations.

While some scholars have criticized the traditional models of college student development for failing to adequately consider the experiences of racially and ethnically diverse students (e.g., Hurtado and Carter 1997; Tierney, 1992), there has been a paucity of viable alternatives. Recent work by Museus (2014) on Culturally Engaging Campus Environments (CECE) presents a promising direction for integrating crucial insights from both the college student development and critical perspectives. While attending to the pre-college inputs and external influences that constitute important elements of the student development models, the CECE model adds specificity to the often amorphous "college environment" category. Moreover, Museus (2014) frames the environmental component in culturally relevant terms to focus on creating culturally engaging campus environments. The CECE model proposes that the campus environment can affect students' sense of belonging, academic dispositions, and academic performance, which in turn can collectively facilitate positive outcomes. Further testing and refinement of the CECE model holds promise for providing a more holistic understanding of college students' experiences and factors that contribute to racial inequality.

Implications for Practice

Fostering greater racial diversity on college campuses is a worthwhile goal. However, simply admitting a diverse student body is not enough. Higher education institutions have a responsibility to foster positive learning environments for all of their students. This requires attending to negative experiences with diversity, or what other studies have described more broadly as campus racial climates. Prior research has documented how students' experiences of prejudice and discrimination negatively affect their sense of belonging and academic and social engagement (Cabrera and Nora 1994; Cabrera et al. 1999; Hurtado and Carter 1997; Nora and Cabrera 1996). This study further illuminates how negative diversity experiences contribute to inequality in the development of critical thinking skills during college.

Presented findings highlight the importance of promoting meaningful interactions between different racial and ethnic groups on college campuses. Improving racial climates and inter-group relations promises to improve learning outcomes of all students, and in particular the outcomes of African American students. Improving racial climates will require purposeful action on behalf of faculty and administrators to support diversity and create conditions inside and outside of the classroom where students from different backgrounds can engage and learn. Some observers of higher education have noted that campus administrators often do not pay close attention to racial interactions until there is a highly publicized incident (e.g., Harper and Hurtado 2007). This means that the vast majority of experiences of prejudice and discrimination are neither noticed nor attended to. Instead of reacting to publicized incidences, colleges and universities need to actively “audit their campus climates and cultures to determine the need for change” (Harper and Hurtado 2007, p. 20).

Following decades of research, much is known about “the conditions, policies, and practices necessary for achieving racial equity in higher education” (Harper, 2012, p. x). Museus and Jayakumar’s (2012) edited volume highlights the myriad ways in which educators can examine their own campus cultures and cultivate supportive campus environments. Notably, Museus and Jayakumar (2012) highlight the importance of holistic institutional transformation, resulting from continuous efforts of diversity advocates. Altering current patterns will not result from short-term or specific programs but from an authentic commitment to diversity and ongoing vigilance.

This vigilance extends to the classroom. Ample literature demonstrates the crucial role of faculty in fostering positive outcomes for college students (see a review in Pascarella and Terenzini 2005). Dee and Daly (2012) note that, “faculty members can serve as one of the primary conduits through which higher education institutions foster cultural learning among students (p. 169).” More specifically, recent research indicates that faculty interest in student development and classrooms that provide opportunities for intensive dialogue are strong predictors of positive diversity interactions (Saenz et al. 2007). Faculty thus need support and resources, not only for providing instruction, but also for adopting inclusive pedagogical practices that can help to improve campus racial climates and facilitate academic success of all students.

Fostering positive racial climates on college campuses is crucial for facilitating the development of critical thinking skills for all students, and for reducing disparities between African American and White students. As our findings show, negative diversity experiences have notable consequences for the development of critical thinking skills. Moreover, since African American students are more likely to be exposed to negative diversity experiences, these experiences contribute to inequality in the development of critical thinking skills between African American students and their White peers. Higher education institutions have the responsibility for ensuring that all students thrive and learn during their time in college, which necessitates close attention to their campus racial climates.

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