

Critical Thinking Skills of Students of Diverse Backgrounds

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Abstract

First-generation college (FGC) students start schools of higher education with lower academic skills and critical thinking skills (Terenzini et al., 1996) that impact their academic success and prospects of earning academic degrees (Davis, 2010; Katrevich & Aruguete, 2017). This study explored if diverse interactions with students from different races and ethnicities will help FGC students improve critical thinking skills so they can meet the academic demands of higher education. This study used a cross-sectional correlational research design. Participants completed assessments measuring their diverse interactions and critical thinking skills.

The findings of non-parametric Spearman's rank correlation test showed there was a moderate, positive, and statistically significant correlation between FGC students' interactions with students from different races and ethnicities and critical thinking skills, $r(33) = .34$, $p = .045$. From a practical perspective, the research findings can be used to create out-of-class opportunities for FGC students for informal interracial and intercultural interactions with peers to promote the development of critical thinking.

Keywords: critical thinking skills, cognitive development, First-generation college (FGC) students, informal interactional diversity experiences, diverse background

1.0. Introduction

College freshmen across different majors need to think critically from the moment they start an academic program (Conley, 2003). College professors anticipate students are capable to infer, examine written records with contradictory sources, provide support for reasoning, find solutions to difficult problems with obscure answers, draw conclusions, explain material, conduct research, and think profoundly about topics (National Research Council, 2002, as cited in Conley, 2007). While many students encounter difficulties adapting to new academic requirements, the experience is more challenging for first-generation college (FGC) students (Terenzini et al., 1996). Terenzini et al. (1996) discovered FGC students start academic programs at institutions of higher education with lower academic skills including critical thinking skills that put them at academic risk. Lack of critical thinking skills affects FGC students' academic performance and reduces the likelihood of earning a higher education degree (Davis, 2010; Katrevich & Aruguete, 2017). A higher education degree is a path to social advancement and financial well-being (Pew Research Center, 2014). It is imperative to analyze ways to improve critical thinking skills for FGC students.

Gurin et al. (2002) postulated that diverse experiences during college years aid students in developing more sophisticated modes of thought like critical thinking ability. Diverse interactions engage students with different world views and expectations, and, as a result, students experience disequilibrium. They are challenged to think and act in ways that they are unaccustomed to.

A review of quantitative studies indicates that students' out-of-class interactions with culturally and ethnically diverse students during college years are strongly associated with positive outcomes in cognitive development and critical thinking skills (Chang et al., 2006; Hurtado, 2001; Roksa et al. 2017).

Pascarella et al. (2001) argued that incorporating a diversity experience into undergraduate programs might benefit some subgroups of students more than others. The benefits vary in strength and direction for different students depending on their precollege experiences and traits. A relationship between diverse interactional experiences and critical thinking skills may be strong for FGC students given their low precollege academic scores (Davis, 2010; Terenzini et al., 1996). Students with lower academic preparation experienced even greater cognitive benefits from diverse interactions than students with higher academic preparation (Loes et al., 2012; Pascarella et al., 2014). Loes et al. (2012) reported that students with low academic entrance scores had greater improvement in critical thinking skills with interactions with diverse students than students with higher academic scores. Loes et al. (2012) argued students with low academic preparation were less equipped to develop critical thinking skills from academic courses. Diverse interactional experiences might have helped to develop these skills in a remedial manner. Interactions with diverse students may aid FGC students to develop critical thinking skills in the first year of their undergraduate program.

The current study analyzes whether FGC students' critical thinking skills are associated with interactions between students from different races and ethnicities. The research question for this study, "What is the relationship between FGC students' interactions with students from different races and ethnicities and critical thinking skills?"

2.1. Theoretical Framework

The theory of Gurin et al. (2002), "Diversity and Higher Education" (p. 330), serves as a theoretical framework for the current study. The theory is centered on the relationship between students' diversity experiences in higher education settings and educational benefits.

Gurin et al. (2002) put forward a theoretical rationale to support affirmative action in higher education admission policies. "Affirmative action in college admissions is based on the premise that a diverse student body contributes to interactions among students from different backgrounds, which are in turn positively related to desirable outcomes of college" (Pike et al., 2007, p.1). Admission practices supporting affirmative action in higher education were challenged in 1997. Two white students initiated a lawsuit against the University of Michigan and Michigan Law School. The plaintiffs were not admitted to the University of Michigan and Michigan Law School even though they had higher test scores and high school grades than black students who were accepted to these Universities (Crosby et al., 2006). The cases are known as *Gratz v. Bollinger* and *Grutter v. Bollinger* (Stohr, 2004, as cited in Crosby et al., 2006). Empirical research was needed to defend affirmative action admission policies in the sued universities. Gurin et al. accelerated their research in this context.

Gurin et al. (2002) employed Piaget's theory of the social side of cognitive development, Erik Erikson's theory of identity development, Ruble's phase model of transitions, and Langer's theory of mindfulness to explain the development of cognition for students as a result of engagement in diverse multiracial and multicultural experiences. Taking these theories together, they theorized students are more likely to put in the effort and engage in sophisticated modes of thinking when they come across situations that disagree with their accustomed ways of thinking. Students can encounter these situations in a classroom or other places when students meet new people with different expectations and world views. Diverse people and relationships cause disequilibrium. As a result of disequilibrium, students are challenged to think and act in unaccustomed and unscripted ways. These diverse social experiences are important during critical periods of identity development, such as late adulthood and early adolescence when students go through significant transitions such as entering college. The first year of college is especially helpful in fostering cognitive growth. Students become a part of a new academic community with relationships and situations that are incongruent with the experiences in their home culture (Ruble, 1994, as cited in Gurin et al., 2002).

Gurin et al. (2002) outlined learning and democratic outcomes of diversity experiences in the following statement, "Learning outcomes include active thinking skills, intellectual engagement and motivation, and a variety of academic skills.

Democracy outcomes include perspective-taking, citizenship engagement, racial and cultural understanding, and judgment of the compatibility among different groups in a democracy” (p. 334). Critical thinking skills were a part of the achievement of these academic skills.

The theory of Gurin et al. 's (2002) centered on three types of diversity experiences presented in college. They are *structural*, *informal interactional*, and *classroom diversity*. *Structural diversity* is the quantitative makeup of diversity in the student population. *Informal-interactional diversity* includes “the frequency and the quality of intergroup interaction as keys to meaningful diversity experiences during college” (Gurin et al., 2002, p. 333). These interactions mainly take place outside of the structured classrooms (Gurin et al., 2002). *Classroom diversity* is the exposure to diverse experiences in the classroom. Research using the framework of Gurin et al. (2002) has affirmed that informal interactional diversity has stronger impact on students’ cognitive development than classroom diversity (Bowman, 2010; Gurin et al., 2002). Structural diversity is a precondition for experiencing diverse interactions (Gurin, 1999; Pike & Kuh, 2006; Saenz, 2010).

Learning outcomes in the diversity theory of Gurin et al. (2002) were criticized by Lerner and Nagai (2003) because the outcomes were self-reported by students. Grades were not objectively analyzed using school records even though Cooperative Institutional Research Program (CIRP) databases had this data.

This study is focused on the informal interactional diversity experiences described in the theory of Gurin et al. (2002) and learning outcomes such as critical thinking skills. The framework provides theoretical lenses with which to test if there is a relationship between interactions with students from different races and ethnicities and critical thinking skills of FGC students. "The empirical benefits of diversity are more contested than ever, especially at public universities; and any work that can employ proven frameworks to assess relevant student diversity outcomes is increasingly important" (Saenz, 2010, p. 9).

3.0. Literature Review

3.1.0. Informal Interactional Diversity

To address diversity, most universities spend a significant amount of resources during the admission process to raise the number of students applying with multiracial and multicultural backgrounds (Hurtado et al., 1998; Pascarella et al., 2001; Phillips, 2019; Pike & Kuh, 2006; Pike et al., 2007) or incorporate diverse views in the academic program (Phillips, 2019; Pike et al., 2007). While the diversity of the student population is important, the greatest benefits are drawn when students are engaged in ethnically and racially diverse experiences through informal interactional experiences (Gurin et al., 2002; Hurtado et al., 1998).

Informal-interactional diversity includes “the frequency and the quality of intergroup interaction as keys to meaningful diversity experiences during college” (Gurin et al., 2002, p. 333). These interactions take place mainly beyond formal classrooms (Gurin et al., 2002). These interactions occur in student clubs, research labs, dining rooms, student government, recreational sports, on-campus events, cram sessions, working on campus, and other social experiences on campus (Antonio, 2001).

The necessity to defend affirmative action admission policies at the University of Michigan accelerated the research focused on democratic, cognitive, and academic benefits of informal interactional diversity (Gurin et al., 2002). Scholars found a relationship between diverse interactional experiences and a pluralistic orientation (Gurin et al., 2002; Hurtado, 2003), student activism (Astin, 1993), leadership skills (Antonio, 2001), cognitive development (Bowman, 2010; Gurin et al., 2002; Hurtado, 2001), critical and active thinking (Gurin et al., 2002; Hurtado, 2001; Loes et al., 2012; Pascarella et al., 2014), and problem-solving (Gurin et al., 2002; Hurtado, 2001; Hurtado, 2003).

3.2.0. College Students' Critical Thinking Skills and Informal Interactional Diversity Experiences

The founders of the educational outcomes of diversity theory, Gurin et al. (2002), postulated students are likely to engage in sophisticated ways of thinking when they come across situations that disagree with their accustomed ways of thinking. These situations can occur in a class or other places where students meet new people with different expectations. The findings of Gurin et al. (2002) from national data showed informal diverse interactional experiences foster greater cognitive growth in comparison to curricular exposure to diversity.

The subsequent quantitative studies focused on the frequency of diverse interactions and their association with critical thinking skills demonstrated a strong relationship (Chang et al., 2004; Chang et al., 2006; Pascarella et al., 2001; Pascarella et al., 2014). Loes et al. (2012) discovered that the overall effect of diverse interactions on critical thinking was not strong. The scholars discovered conditional effects of diverse interactions for students from different races and with different precollege academic scores. The students with low precollege academic scores experienced greater critical thinking growth from diverse interactional experiences than the students with higher academic scores. Loes et al. (2012) argued that diverse interactional experiences may help in a compensatory manner students with low academic preparation during the first year of college. Lack of academic preparation prevented them from developing critical thinking skills from structured academic programs. White students experienced greater growth of critical thinking with diverse interactional experiences than racially diverse students. The effect varied in strength and direction. White students in the sample went to segregated high schools. Diverse interactional experiences were novel for them. Novel experiences led to cognitive growth. The majority of racially diverse students attended diverse high schools. The results aligned with the findings of Pascarella et al. (2001). White students experienced greater critical thinking skill benefits from diverse experiences than racially diverse students. Pascarella et al. (2014), using a stricter level of statistical significance ($p < 0.01$) in a four-year study, failed to find a conditional effect of race. They identified it at $p < 0.05$. Pascarella et al. (2014) argued as American universities become more diverse, the conditional impact of diversity experiences on critical thinking skills might be expected. It would be useful to discover subgroups of students for whom diversity experiences would aid in learning.

Within the diversity framework, the majority of studies focused on the effect of racial and ethnic diversity on cognitive development (Chang et al., 2004; Gurin et al., 2002; Laird, 2005). Some studies expanded the construct by including gender (Pascarella et al., 2001), political (Loes et al., 2012; Pascarella et al., 2001; Pascarella et al., 2014), or religious diversity (Pascarella et al., 2001; Roksa et al., 2017). Bowman (2010) analyzed 23 studies and reported that engagement in racially diverse interactions is strongly related to cognitive development rather than engagement in non-racially diverse interactions. These interactions are not perceived as novel. They do not surprise students, so they do not affect cognitive growth (Bowman & Brandenberger, 2012).

3.3.0. First-Generation College Students

3.3.1. Personal and Academic Characteristics of FGC Students.

According to the Pell Institute, “*First-generation* is defined as neither parent nor guardian having attained a bachelor’s degree” (Cahalan et al., 2022, p.206). FGC students across the nation comprised 56% of the undergraduate student population in 2015-2016 (RTI International, 2019).

FGC students show a number of personal and academic characteristics that distinguish them from traditional students. They tend to be older than traditional students, have low socioeconomic status, and are committed to jobs (Chen, 2005; Saenz et al., 2007; Terenzini et al., 1996). They are likely to be married and have children (Nuñez & Cuccaro-Alamin, 1998; Terenzini et al., 1996). They are likely to belong to racial and ethnic minority groups as Black and Latino students (Chen, 2005; Choy, 2001; Dong, 2019; Martin Lohfink & Paulsen, 2005; Terenzini et al., 1996).

In terms of academic preparation, FGC students enter colleges either with a low GPA, low entrance exam scores, or no entrance exams (Chen, 2005; Choy, 2001; Saenz et al., 2007; Terenzini et al., 1996; Warburton et al., 2001). After undergraduate enrollment, FGC students continue being disadvantaged with low academic performance in their first year and are less likelihood to graduate from institutions of higher education (Chen, 2005; Choy, 2001; Warburton et al., 2001). FGC students are more likely to be enrolled in remedial courses to meet the academic demands of higher education (Chen, 2005; Nuñez & Cuccaro-Alamin, 1998; Warburton et al., 2001). There is a 71% higher likelihood that FGC students will leave college in their first year than for traditional students (Ishitani, 2003).

3.3.2 FGC Students' Critical Thinking Skills

The research on FGC students' critical thinking skills is limited and focused on course-related critical thinking skills (Katreovich & Aruguete, 2017; York, 2016) and skills developed as a result of participation in higher education experiences (Filkins & Doyle, 2002; Pascarella et al., 2004).

Katrevich and Aruguete (2017) reported as a result of participating in math courses, 74 FGC students demonstrated lower math course-related critical-thinking scores than 86 traditional students. These scores predicted their GPA and grades in math. Nationwide attendance of service-learning courses by 5000 low-income FGC students was related to the development of critical thinking, analytical problem-solving, and evaluative skills (York, 2016).

Critical thinking growth as a result of involvement in higher education experiences was explored in a longitudinal study by Pascarella et al. (2004). Engagement in academic, classroom and out-of-class activities significantly influenced FGC students' gains in critical thinking. The effect was stronger for FGC students than for traditional students even though FGC students had limited opportunities to engage in higher education experiences due to work commitments, taking fewer classes, and living off-campus. The findings of Filkins and Doyle (2002) supported these results. The researchers assessed the effect of positive academic practices on students' results for 1446 TRIO-eligible low-income or FGC students and 450 non-Trio-eligible students from urban institutions. For both populations, "involvement in active/collaborative learning activities and interacting with faculty was positively related to their cognitive and affective growth during college" (Filkins & Doyle, 2002, p. 14). Low-income FGC students benefited more from class presentations, class discussions, and collaborative learning activities than non-TRIO-eligible students (Filkins & Doyle, 2002). These findings affirm that cognitive development of FGC students is shaped by experiences extending beyond structured academic activities (Pascarella et al., 2004) and the experiences that connect academic and nonacademic life (Terenzini et al., 1996).

3.3.3. Interactional Diversity Experiences of FGC Students

The majority of studies pertaining to FGC students' diverse interactions are focused on negative interactions between minority FGC students of color with white students and faculty. Researchers have conducted qualitative studies and determined that many multiethnic and multiracial FGC students experience microaggression, segregation, marginalization, isolation, and intimidation during encounters with white peers in a college setting defined by white values (Adams & Mc Bryer, 2020; Adsitt, 2017; Balcacer, 2018; McCorkle, 2012; Pyne & Means, 2013).

The myriad of diverse interactions including positive and negative ones were described in Darling's study (1999). He analyzed stories about college experiences in connection with the home culture of eight rural, FGC students from Southern Appalachia. One of the key themes that was revealed on the completion of study was identity. The students matured and grew into independent thinkers as a result of gaining new knowledge, new multicultural experiences, a date/mate or friends from different racial and ethnic groups, reevaluating family and cultural values or integrating them into a new environment. Southern Appalachian students came from a culture that valued close connections to family, kin and neighborhood communities. Students looked for these connections in the university. Over the course of the journey some students experienced frustration with family members who had conservative beliefs and criticized representatives from other religions and cultures (Darling, 1999). All of the students interacted with diverse peers through class projects and group activities, students' organizations, on campus jobs, and visiting residence-halls. Darling (1999) argued the key to students' open mindedness and learning was an opportunity to get to know people from different backgrounds.

The effect of first-generation status on the frequency of diverse interactions was explored in the study of Dong (2019). He discovered a positive effect of first-generation status on the frequency of diverse interactions for 800 FGC students from 16 private liberal arts colleges. These findings contradict previous research. Lundberg et al. (2014) found that 1943 undergraduate FGC students are less involved with students' acquaintances than traditional students, as a result, they have less exposure to interactional diversity. The lack of engagement in interactional diversity had a negative effect on FGC students' academic performance. The findings of Lundberg et al. (2014) were in line with the results of Pascarella et al. (2004) who argued FGC students tend to be less engaged in peer networks in comparison to traditional students due to job responsibilities, living off-campus, and taking fewer courses. Although FGC students experienced greater cognitive and intellectual growth if they were exposed to peer interactions (Pascarella et al., 2004). Conflicting results on the frequency of FGC students' diverse interactional experiences call for further research on this topic.

4.0.0. Method

The research question, "What is the relationship between FGC students' interactions with students from different races and ethnicities and critical thinking skills?" was addressed using a cross-sectional correlational research design.

4.1.0. Participants

The study included participants who gave informed consent to participate in the study, who were at least 18 years of age, were in the first year of undergraduate four-year schools and had never taken undergraduate courses before the current school year.

Sixty-one FGC students from 17 culturally and ethnically diverse public and private four-year institutions in New England responded to recruitment efforts. New England is a region that includes six states in the Northeastern part of the United States such as Maine, Connecticut, New Hampshire, Rhode Island, Massachusetts and Vermont. After preliminary analysis, 35 students were included for future analyses.

The participants ranged in age from 18 to 25 years. The average age was 18.91 years ($SD = 1.17$). Predominantly White, Caucasian, Anglo American ($n = 18, 51.4\%$) students participated in the study. Hispanic, Latino, Mexican American FGC students ($n = 7, 20\%$) were the next largest group of students. A few participants were Asian, Asian American, Pacific Islander ($n = 5, 14.3\%$), and Black, African American ($n = 5, 14.3\%$) students. The majority of participants identified as female ($n = 32, 91.4\%$). Few participants identified as males ($n = 3, 8.6\%$).

4.2.0. Recruitment

At the end of the fall semester in 2021, school officials from three institutions of higher education sent an e-mail invitation to first-year FGC students. The study invitation email stated that students would need to complete two online assessments and a short demographic survey. The recruitment email provided a definition of FGC: "*students whose parents did not attend undergraduate schools or attended but did not graduate from undergraduate school*".

To attract participants, a raffle to win one of three \$50 Dunkin' Donuts gift cards was offered.

At the end of the email, the students were prompted to read two attachments: an informed consent form and instructions for completing online assessments. Interested students were directed to follow the links to instructions for completing online assessments to participate in the study. The participants had a chance to enter contact information for the raffle using the link in the informed consent form. One student participated in the study. None of the participants submitted information to participate in the raffle.

Due to a low response rate, 14 additional four-year institutions in New England were contacted for recruitment over the course of the Spring 2022 semester. New recruitment strategies were added in which school officials sent email invitations with informed consent and instructions for completing online assessments to FGC students 2-3 times. Participation in a raffle was eliminated. Each participant had a chance to receive a \$15 Amazon eGift card by voluntarily entering contact information. Some institutions also posted a flyer, "Study Invitation", on university bulletin boards, in a newsletter, or shared among first-year students. At the end of the flyer, eligible participants were prompted to follow the links to read the informed consent and instructions for completing the online assessments.

4.3.0. Measures

4.3.1. Demographic Survey

The demographic survey (Appendix F) was a part of the CCTST. Participants answered questions about their sex, age, and ethnicity.

4.3.2. Positive Cross-Racial Interaction (CRI)

This measure is a part of the Diverse Learning Environments (DLE) Survey with seven questions (Hurtado et al., 2015). The Positive CRI is "a unified measure of students' level of positive interaction with diverse peers" (Hurtado & Guillermo-Wann, 2013, p.15).

The Positive CRI has seven questions about the frequency of students' engagement in interactional activities with students from another racial/ethnic group using a 5-point Likert scale. The scale offers responses from 1 to 5, with 1 meaning "never" and 5 meaning "very often." The range of total scores is from 7 to 35, with higher scores suggesting more frequent interactions with students from different racial and ethnic groups. Examples of sample questions included "Have you had intellectual discussions outside of class with people from another racial/ethnic group?", "Have you dined or shared a meal with people from another racial/ethnic group?", and "Have you had meaningful and honest discussions about race/ethnic relations outside of class?"

Hurtado et al. (2015) presented internal consistency reliability (Cronbach's α) for cross-racial interaction (CRI) as .88. Individual factor loadings ranged from .54 to .84.

4.3.3. California Critical Thinking Skills Test (CCTST)

The participants took the online version of the CCTST. The CCTST measures participants' overall critical thinking skills and its domains such as "analysis, interpretation, inference, evaluation, explanation, induction, and deduction" (Insight Assessment, 2021, p. 6).

The CCTST was analyzed in terms of validity and reliability to estimate critical thinking in higher education students (Facione, 1990). Content validity was supported by aligning the test items with the American Philosophical Association (APA) Delphi Panel's definition of critical thinking (Facione, 1990). Criterion and construct validity were achieved by demonstrating increases in the CCTST after critical thinking interventions and positive correlations with GRE measures of college students' preparedness in higher-order reasoning (Insight Assessment, 2017). Facione (1991) reported reliability of the CCTST using KR-20, "the CCTST reliability coefficient (Kuder-Richardson 20) was .69 on the pretest and .68 on the posttest. These coefficients fall within the .65 to .70 range recommended for tests which purport to target a wide range of CT skills" (Facione, 1991, p. 5).

The CCTST has 34-item multiple-choice questions about everyday situations. Items are presented with text, charts, or images. Respondents analyze and clarify information, draw inferences, and make an evaluation of inferences and reasoning (Insight Assessment, 2021). The CCTST takes approximately 45-50 minutes to complete (Insight Assessment, 2021).

Data Analyses and Findings

5.0.0. Data Analyses and Findings

Prior to answering the research question, the preliminary analysis was run. It included checking data for missing values, outliers, and verification of assumptions of simple linear regression. The variables were assessed for outliers, linearity, univariate normality, and homoscedasticity. Non-normal distribution of CCTST and Positive CRI scores indicated that the assumption of normality was not met for either of the primary variables. A non-parametric Spearman's rank correlation test was selected because it does not assume normality in the data (Schober et al., 2018).

5.1.0 Descriptive Statistics for Primary Variables

The independent variable is interactions with students from different races and ethnicities which is the total Positive CRI score. Mean, standard deviation, and range were calculated for interactions with students from different races and ethnicities. See Table 1 for this information (Appendix A).

The dependent variable is critical thinking skills. This is the overall CCTST score. Mean, standard deviation, and range were calculated for critical thinking skills. See Table 2 for this data (Appendix A).

The scoring protocol for CCTST was also used to determine whether participants' scores were weak, moderate, strong, or superior. The scores in the range of 0-7 are considered *not manifested*. Weak scores fall within the range of 8-12, *moderate* scores fall within the range of 13-18, *strong* scores fall within the range of 19-23, and *superior* scores are higher than 24 (Insight Assessment, 2021). FGC students in the sample scored in a wide range on the CCTST. Participants' scores ranged from 8-24. Eleven percent of FGC students ($n = 4$) received superior CCTST scores. The average superior score was 24 ($SD = 0$). Twenty percent of FGC students ($n = 7$) received strong CCTST scores. The average strong score was 20.86 ($SD = 1.57$). Thirty-seven percent of students ($n = 13$) received moderate CCTST scores. The average moderate score was 15.69 ($SD = 1.70$). Thirty-one percent of students ($n = 11$) received weak CCTST scores. The average weak score was 10 ($SD = 1.27$).

5.2.0 Demographic and Primary Variables

To determine if participants' demographic variables were related to either of the primary variables, a set of analyses was conducted.

Spearman's rank correlation was computed to assess the relationship between FGC students' interactions with students from different races and ethnicities and age. This test was used because the interactions with students from different races and ethnicities data did not satisfy the assumption of normality. The results showed that the variables are not correlated, $r(33) = -.06, p = .73$. This indicates that there is not a relationship between FGC students' age and interactions with students from different races and ethnicities.

Since the researcher had a low number of males ($n = 3$) in the sample, the differences in FGC students' interactions with students from different races and ethnicities among males and females were not examined.

A Kruskal-Wallis H test was run to see if there was a statistically significant difference in the interactions with students from different races and ethnicities between FGC students of different ethnicities. The Kruskal-Wallis H test is a non-parametric test that is used to determine if there are statistically significant differences between two or more data samples (Marshal & Boggis, 2016). This test was used because the data on interactions with students from different races and ethnicities were not normally distributed. The results showed that there was not a statistically significant difference between interactions with students from different races and ethnicities of FGC students from different ethnicities, $H(3) = 2.32, P = 0.508$. This means ethnicity does not seem to impact FGC students' interactions with students from different racial and ethnic backgrounds.

Spearman's rank correlation was computed to assess the relationship between FGC students' critical thinking skills and age. This test was used because the critical thinking skills data were not normally distributed. The results showed that the variables are not correlated, $r(33) = -.09, p = .616$. This indicates that there is not a relationship between FGC students' age and critical thinking skills. Since the researcher had a low number of males ($n = 3$) in the sample, the differences in FGC students' critical thinking skills among males and females were not tested.

A Kruskal-Wallis H test was run to see if there was a statistically significant difference in critical thinking skills between FGC students of different ethnicities. This test was used because the critical thinking skills data did not satisfy the assumption of normality. There was not a statistically significant difference between critical thinking skills of FGC students from different ethnicities, $H(3) = 5.41, P = 0.144$.

The analyses indicate that age, gender, and ethnicity do not seem to impact FGC students' interactions with students from different ethnic and racial groups or their critical thinking skills.

5.3.0. Primary Analysis

To answer the research question, "What is the relationship between FGC students' interactions with students from different races and ethnicities and critical thinking skills?" a Spearman's rank correlation analysis was run. This test was used because the critical thinking skills and interactions with students from the different races and ethnicities data did not satisfy the assumption of normality. Spearman's rank correlation coefficient was estimated using the total score of the Positive CRI test and the overall score of CCTST.

There was a moderate, positive, statistically significant correlation between two variables, $r(33) = .34, p = 0.045$. This indicates that interactions with students from different races and ethnicities are significantly related to the critical thinking skills of FGC students.

Limitations

6.1.0. Discussion

The findings of this study affirmed the argument of Gurin et al. (2002) that ethnically and racially diverse experiences stimulate sophisticated ways of thinking. They also contributed to his theory (2002) supporting the premise that the benefits of diversity experiences have a conditional nature (Loes et al., 2012; Pascarella et al., 2014). As was expected, FGC students showed significant cognitive growth from exposure to diverse interactional experiences in the current study. The Spearman's rank correlation analysis indicated that the relationship between diverse interactional diversity experiences and critical thinking skills was positive and statistically significant $r(33) = .34, p = 0.045$.

As predicted, low academic preparation might have aided FGC students in drawing significant benefits of critical thinking from diverse interactions in a compensatory way (Loes et al., 2012; Pascarella et al., 2014). They were not academically prepared to draw these cognitive benefits from the academic program.

On average, FGC students from the current sample experienced fairly frequent interactions with students from diverse backgrounds. The total average score was 26.09 ($SD = 7.55$). They participated in multicultural events, dined, partied, discussed, shared personal feelings, and prepared schoolwork with ethnically and racially diverse peers. The results conflict with previous research findings suggesting that FGC status has a negative effect on the frequency of interactions with acquaintances of different backgrounds (Lundberg et al., 2007), and affirm research results from Dong (2019). Dong (2019) discovered a positive main effect of first-generation status on the frequency of diverse interactions. Contradictory research results call for further studies of this topic.

Fairly frequent interactions of FGC students with students from different races and ethnicities can be explained by the fact that FGC students were recruited from racially and ethnically diverse institutions of higher education. Representation of racially diverse students was high at these institutions. This means structural diversity was stressed in the selected institutions of higher education. The research states structural diversity is a precondition for engaging in meaningful interactions (Gurin, 1999; Pike & Kuh, 2006; Saenz, 2010), since "it is associated with exposure to diverse viewpoints as well as diverse people" (Pike & Kuh, 2006, p. 443). The on-campus diversity of the participating data sites predisposed FGC students to frequent interactions with racially and ethnically diverse peers.

The total average CCTST score for the participants was 15.89 ($SD = 5.1$) falling within the higher end of the moderate range. Moderate critical thinking skills growth was attributable to the informal interactions with students from different races and ethnicities. The results echoed the findings of Pascarella et al. (2004) from a longitudinal study. Engagement in extracurricular activities had a strong positive effect on critical thinking for FGC students at the end of the third year. The scholars argued cognitive development of FGC students is shaped by experiences extending beyond structured academic activities that are a common practice in many institutions of higher education (Pascarella et al., 2004). The current study showed that the cognitive effect based on nonacademic experiences for FGC students begins as early as their first year.

In the current study, ethnicity did not seem to impact FGC students' interactions with students from different racial and ethnic backgrounds or their critical thinking skills. Dong (2019) similarly found that for 800 FGC students, ethnicity and race did not influence the frequency of diverse interactions or gains in intellectual development including critical thinking skills.

The connection between FGC students' age and interactions with students from different races and ethnicities or critical thinking skills was not discovered. The results were neither surprising nor expected due to the fact that prior research did not include age as a demographic variable that could impact FGC students' interactions with students from different races and ethnicities (Dong, 2019; Lundberg et al., 2007) or critical thinking skills (Filkins & Doyle, 2002; Katreovich & Aruguete, 2017; York, 2016). It will be worthwhile to recruit larger samples of age-diverse FGC students and explore if age impacts their diverse interactional experiences. Ajrouch et al. (2001) argued that adult age is associated with size, diversity, propinquity of networks, and the frequency of contacts within the networks.

Failure to find a relationship between age and critical thinking skills might be attributable to the nature of cognitive development in college students. Comparison of cognitive development in college students with children does not proceed in a linear manner (Wankat & Oreovicz, 1993). It is accelerated with new experiences, ideas, and interactions Perry (1974). Cognitive growth is the effect of both maturity and college experiences (King & Kitchener, 2004). The age alone does not impact students' gains in critical thinking. Other factors come into play to stimulate their critical thinking growth. Informal diversity interactions proved helpful for critical thinking growth of FGC students in current research.

6.2.0 Limitations of the Current Study

This study has several limitations. The first limitation is related to the participants of this study. The study included students from 17 ethnically and culturally diverse undergraduate four-year schools in New England. Based on this number of participants, it is likely that research findings may not be generalized to other undergraduate communities.

Another limitation is the sample in this study was attracted using a convenience sampling method. This sampling technique involves sampling bias, as it "does not guarantee that all eligible members of a population have an equal chance of being included in a sample" (Skowronek & Duerr, 2009, p. 413). It is possible that the students who were interested in the study, who believed that they had a high frequency of diverse interactions or high critical thinking skills chose to participate in the study. Future researchers should consider using random sampling techniques so that eligible participants would be representative of the population being studied.

The size of the sample is a limiting factor. The estimated range of participants from 103 to 171 required to achieve a power of 0.80% was not achieved (Faul et al., 2007). Since this power level was not achieved, there is a possibility that a Type I error can be made (Shreffler & Huecker, 2021).

Another limitation of the study is that the independent variable is categorized as students' perceptions, not their behavior. The Positive CRI measure did not measure the actual interactions with culturally and ethnically diverse peers among FGC students, rather it reflected values FGC students attributed to these interactions.

There is a limitation regarding the FGC students' category. The category is limited to students whose parents did not attend undergraduate schools or attended but did not graduate from undergraduate schools. By adding types of parental educational backgrounds in future work on FGC students, researchers may be able to provide a more detailed analysis of students' experiences. For example, the researchers could differentiate between students whose parent or parents did not attend a four-year college, received an associate degree, or started college but did not finish.

Lastly, several extraneous variables such as FGC students' pre-college critical thinking skills, college major, coursework in liberal arts were not taken into account in this study. With the presence of these variables, the relationship between FGC students' interactions with students from different races and ethnicities and critical thinking skills might be inaccurate (Pourhoseingholi et al., 2012). It may be a benefit to investigate which variables could impact the relationship between interactions with students from different ethnicities in future studies and include them in data analyses.

6.3.0. Implications of the Current Study

6.3.1. Practical Implications

FGC students' low academic achievement during the first year and attrition rate received considerable attention in the research literature (Chen, 2005; Choy, 2001; Warburton et al., 2001). FGC students are more likely to take remedial courses to meet the academic demands of higher education (Chen, 2005; Nuñez & Cuccaro-Alamin, 1998; Warburton et al., 2001). While an extra dose of supplementary instruction for FGC students may be helpful, learning is not limited to academic classrooms. Learning stretches beyond the classroom to various social contexts: extracurricular programs, libraries, multicultural events, peer social networks, learning communities, neighborhoods, and families. For specific subgroups of students, social experiences outside of the classroom could have more value than classroom learning. Interactions with students from different races and ethnicities that took place while dining, participating in homework study sessions, and attending parties and multicultural events helped FGC students gain critical thinking skills. There was significant positive relationship between interactions with students from different races and ethnicities and critical thinking skills ($p = 0.045$). Diverse interactions produced states of disequilibrium for FGC students. This disequilibrium challenged FGC students to question their existing views. As a result, critical thinking growth was stimulated.

Based on the current findings, it is important to reevaluate the current educational practices for FGC students. It is essential to reduce course load and provide FGC students with more time for authentic dialogue with racially and ethnically diverse peers. Diverse interactional experiences do not require significant financial outlays and commitments from FGC students or the institutions of higher education. They occur naturally if universities stress affirmative action admission policies and increase the proportion of students from different races and ethnicities in their student population. Structural diversity is a precondition for engaging in meaningful interactions (Gurin, 1999; Pike & Kuh, 2006; Saenz, 2010). FGC students have a better chance to meet diverse individuals in diverse settings.

To yield better results, educators, scholars, policymakers, and school and student leaders could adopt policies encouraging FGC students to have meaningful informal interactions with students from different races and ethnicities.

They could introduce additional break time in daily schedules and organize numerous field trips and multicultural events. School leaders could create and support an inclusive culture on campus where racially and ethnically diverse students feel equally valued for their differences. A supportive racial climate significantly predicts diverse interactional experiences (Cox, 2010).

Educators could award FGC students with extra credits if they consistently participate in extracurricular programs such as music, sports, arts, community service clubs, and work on campus. Cross-cultural groupings of students for these activities would be beneficial. By having these opportunities, FGC students will be able to engage in multiracial and multicultural dialogue and improve their critical thinking skills.

Research shows that students from the same race tend to “flock together” (Godley, 2017). This phenomenon is known as racial homophily. Racial homophily is a tendency to form networks with same-race individuals (Mollica et al., 2003). To minimize the effect of racial homophily, it is important to introduce to FGC students the educational value of intercultural communication from the moment they step into the college classroom. It will be worthwhile to explain that discomfort is common while interacting with students from different racial and ethnic groups. FGC students should embrace and celebrate this discomfort as it is the beginning of their cognitive growth. Such awareness will stimulate FGC students be open to diverse experiences and making interracial friends.

6.3.2 Theoretical Implications

The results of these studies contribute to research on several topics. The findings of this study provide further support to growing research on the conditional effects of diversity experiences on critical thinking skills (Loes et al., 2012; Pascarella et al., 2014). This research indicates that some groups of students can derive greater cognitive benefits than others, depending on their precollege characteristics. The fact that FGC students in this sample demonstrate significant cognitive growth from diverse interactions endorses the idea that the researchers need to conduct additional studies with other groups of students for whom diverse interactions could be beneficial (Pascarella et al., 2014). These can be students with moderate or severe disabilities, immigrant or refugee students, or rural or suburban students.

The findings add to the research on informal diversity interactions of FGC students across different races. Previous studies focused on negative interactions of minority FGC students of color in a college setting determined by white students' cultural values (Adams & Mc Bryer, 2020; Adsitt, 2017; Balcacer, 2018; McCorkle, 2012; Pyne & Means, 2013). The current study focused on positive, meaningful, and informal diversity interactions. Participants were representatives of four ethnicities: White, Caucasian, Anglo American; Hispanic, Latino, Mexican American; Asian, Asian American, Pacific Islander; and Black, African American students. In the current study, FGC students across all ethnic groups had similar exposure to positive, informal, diverse interactions. The structural diversity of institutions they attended might have predisposed them to diverse interactions in similar ways. The statistical findings contribute to limited research on diverse interactions of multiethnic and multiracial FGC students. They also call for future research on institutional factors like structural diversity that influences interactions of multiethnic and multiracial FGC students across ethnic and racial lines.

6.3.3. Suggestions for Future Research

There is a wide range of opportunities to research informal interactional diversity experiences and the critical thinking skills of FGC students. The current research focuses on positive interactions among racially diverse FGC students. Future researchers could add to these findings by focusing on the positive and negative diversity interactions of FGC students. The previous studies indicate that positive and negative interactions have different effects on the growth of critical thinking skills (Hurtado, 2003; Roksa et al., 2017). It would be worthwhile to investigate if the effect is the same or different with positive and negative interactions on critical thinking growth in FGC students.

Future studies comparing the interactional diversity experiences of FGC students with traditional students would be beneficial. The studies could show how these two groups of students differ from one another on critical thinking skill gains through involvement in interactions with students from different races and ethnicities. This study only looked at the experience of FGC students.

It may be a benefit to devise a standard definition of interactional diversity experiences to increase the generalizability of findings across the studies. The review of the literature suggests there are numerous definitions for informal diversity interactions (Chang et al., 2004; Gurin et al., 2002; Hurtado, 2003; Pascarella et al., 2001; Roksa et al., 2017). The ambiguity and inconsistency in the conceptualization presents a problem to the external validity of findings across studies.

Future researchers could consider conducting mixed method studies to see if the relationship is consistent among interactions with students and critical thinking skills across quantitative and qualitative studies. This will allow researchers to strengthen reliability and validity of their results (Abowitz & Toole, 2010).

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Appendix A

Table 1

Descriptive Statistics for Interactions with Students from Different Races and Ethnicities

Variable	<i>M</i>	<i>SD</i>	Possible Range	Sample Range
Interactions with Students from Different Races and Ethnicities	26.09	7.55	7-35	11-35

Table 2

Descriptive Statistics for Critical Thinking Skills Variable

Variable	<i>M</i>	<i>SD</i>	Possible Range	Sample Range
Critical Thinking Skills	15.89	5.1	0-34	8-24