

Meta-Analysis of How Race is Discussed in RUME Proceedings from 2019 – 2024

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In the last 20 years, mathematics education research has taken a more critical lens (Gutiérrez, 2013), in which researchers focus on salient features of students' identities (e.g., race, ethnicity, gender) to analyze the structures within mathematics and schools to motivate change to power structures and systems that oppress such groups. In recent years, there has been a notable change in the types of submissions to the RUME community. This paper details a meta-analysis of the RUME proceedings from 2019 to 2024. Using 60 keywords related to racial identity, we sorted papers based on how they discussed race and its centrality in their work. A total of 33 papers were identified as directly engaging work that focuses on race. We draw conclusions of what may be missing in current research, and the ways we may more meaningfully engage in race-conscious research in mathematics education.

Keywords: Race, Ethnicity, Meta-Analysis

In 1995, Ladson Billings and Tate introduced Critical Race Theory (CRT) into the education field, beginning a new era of research of race in education. Tate (1995) engaged CRT within mathematics education through the development of culturally relevant pedagogy, offering an alternative pedagogy that is founded on that idea mathematics should “implement a pedagogy of social change” (p. 171). Contemporary scholars have integrated CRT within mathematics education research. Martin (2009) focused on race, (re)conceptualizing the goals of mathematics education for racially marginalized groups. Gutiérrez (2009) developed an equity framework which argues that equity is achieved along a Dominant axis and Critical axis, keeping at the forefront racially minoritized students. The Dominant axis represents access and achievement within an existing system (e.g., test scores, passing rates, economic success) for racially marginalized students. The Critical axis indicates that students' racial identities are acknowledged, and that students are empowered to become agents of change in a racially unjust mathematics system. Jett (2012) and Davis (2022) have called for mathematics educators to embrace the intersectionality of CRT and mathematics disciplinary knowledge to continue to advance racial justice in mathematics education. In response to the endemic nature of racism, scholars must continue the work of pushing for social justice within mathematics education.

In recent years, we have noticed that the topic of race has become more prevalent within RUME proceedings. Due to the increased interest in issues of diversity, equity, and inclusion (DEI), and because DEI has become a ubiquitous term to capture many different student populations, we wanted to focus specifically on race to capture how our research community engages with the topic, that is: How has the RUME community engaged with race within the paper submissions for the RUME conference from 2019 – 2024? We present here a meta-analysis of the last six years of RUME proceedings related to race. This meta-analysis is guided by two tenets of CRT: 1) the centrality and intersectionality of race and racism and 2) there must be a commitment to social justice within education (Solórzano, 1998).

Identifying Papers that Discuss Race or Ethnicity

Our research team collected six years of the RUME proceedings from 2019 to 2024. These proceedings included all finalized submissions that were labeled as contributed reports (seven pages), preliminary reports (five pages), theoretical reports (seven pages), and posters (one page). Data used for this paper included only contributed, preliminary, and theoretical reports. We excluded posters because, due to limitation of length, we could not easily discern the intention of some papers in the same way as we could for longer reports.

We utilized 60 keywords to search each set of proceedings. Keywords included words that related to (a) the topic of race (e.g., multiracial, ethnicity, of color), (b) specific racial groups (e.g., Asian, Black, Latin*), (c) minority-serving institutions (e.g., HSI, HBCU), and (d) phrases related to a critical theoretical lens (e.g., critical race theory, antiracist, whiteness). After a lengthy discussion, we did not include phrases that were not specific to race or ethnicity, such as social justice, marginalized, or equity. We came to this decision as we recognized that using phrases like this groups together many identity characteristics under one umbrella and does not distinguish the focus of the research. For example, a paper can claim that it focuses on equity, yet only specifically discusses gender disparities without mentioning the race or ethnicity of the participants or impact of findings on racial groups. Similarly, papers that focus on social justice could discuss themes related to global warming or broader human rights. Essentially, a paper needed to directly discuss race in some capacity to be captured by our keyword search.

After completing the search using the list of keywords, we identified 207 papers that had at least one mention of any of the words. The highest number of words found in one paper was 26 and the least number of words present was one. Table 1 shows the distribution of papers with keywords by year. The *N* values for each year reflect the number of contributed, preliminary, or theoretical reports that were present in the set of proceedings. Notice that the number of papers containing keywords increases over the timeframe, with the 2021 proceedings containing fewer papers due to the COVID-19 pandemic. We see that about a quarter of all six sets of proceedings analyzed here contained a keyword.

Table 1: Distribution of Papers that Contained Keywords by Focus of Race in the Paper

Year	Papers with Keywords		Core		Peripheral		Unrelated	
2019 (<i>N</i> =133)	21	(15.8%)	1	(0.8%)	16	(12%)	4	(3%)
2020 (<i>N</i> =148)	30	(20.3%)	4	(2.7%)	21	(14.2%)	5	(3.4%)
2021 (<i>N</i> =49)	12	(24.5%)	1	(2%)	9	(18.4%)	2	(4.1%)
2022 (<i>N</i> =145)	40	(27.6%)	12	(8.3%)	20	(13.8%)	8	(5.5%)
2023 (<i>N</i> =151)	47	(31.1%)	7	(4.6%)	35	(23.2%)	5	(3.3%)
2024 (<i>N</i> =154)	57	(37%)	8	(5.2%)	39	(25.3%)	10	(6.5%)
Total (<i>N</i>=780)	207	(26.5%)	33	(4.2%)	140	(18.0%)	34	(4.4%)

Once we compiled the list of papers that referenced at least one keyword, we began to determine the degree to which the paper focused on race or ethnicity. We adapted three codes to capture this: *Core*, *Peripheral*, or *Unrelated* (Boeck et al., 2024). A paper was considered *Core* if it meaningfully engaged with race. This meant that the paper had race as a focal component of the theoretical framing, data analysis, or findings. A paper was not considered *Core* if the paper engaged in quantitative analysis and only used race as a control variable. If we were not sure that

the paper meaningfully engaged with race, we then turned to counting the keywords such that if the keywords appeared throughout the paper, and at least one keyword appeared at least three times in the body of the paper, then the paper would be considered *Core*. A paper was considered *Peripheral* if the keywords were used to describe only demographic information, were used only once, had limited mention, or were secondary to a larger focus of the paper. A paper was considered *Unrelated* if the keyword was only present in the references, used in a list of protected categories, or used in a citation from another scholar.

Whenever a researcher could not determine if a paper was considered *Core* or *Peripheral*, it was labeled as *Ambiguous*. The research team met to discuss these papers and determine their category. We also struggled with how to determine studies that focused on language or multilingual learners, and whether language not only connected to culture, but also possibly to racial identity. We drew from LatCrit (Chávez-Moreno, 2024) to support the argument that differential treatment of multilingual students is the racialization of these students.

Table 1 shows the distribution of the focus of race by year across the papers. A total of 33 papers were identified as *Core*, representing 4.2% of all proceedings ($N=780$), and 15.9% of reports analyzed ($N=207$). 140 papers were identified as *Peripheral*, representing 18.0% of all proceedings ($N=780$), and 67.6% of reports analyzed ($N=207$) papers. This group was rather large due to the wide variety of purposes for using these keywords. On one hand, some papers only had a singular keyword to describe an institution or demographic of participant. On the other hand, we had papers that had race as a secondary focus of the paper.

After identifying *Core* papers, the research team categorized the papers using the following: (a) Population of interest (e.g., students, faculty, pre-service teachers), (b) Focus (e.g., curriculum, social interactions/instruction, student supports, beliefs/attitudes), (c) Mathematics course, (d) Theoretical Framing (e.g., critical race theory, positionality), (e) Methods (e.g., qualitative, quantitative, mixed methods), (f) Dominant or Critical focus (Gutiérrez, 2009). We selected these categories to highlight the density of key components of the research studies, with the goal to inform the RUME community of areas for continued study. *Population of Interest* and *Math Course* were categories to help understand which populations are the focus of this work. The *Focus* category highlights the topic of interest for the study. For example, *Social Interactions and Instruction* include classroom instruction or group work, where *Beliefs or Attitudes* represents work that attempts to measure or reshape people's beliefs about issues around race. To understand the nature of race-conscious studies, we coded *Theoretical Frameworks* to broadly understand how researchers framed their studies. We also captured the methods that authors used to analyze studies related to race. Finally, we adapted Gutiérrez's (2009) framework of equity along *Dominant* and *Critical* axes to account for specific dimensions studied within the papers.

Findings

We discuss key findings related to the papers that contained keywords. First, we will look at overall trends of keywords over time from 2019-2024. Then, we will discuss what we found related to the *Core* papers related to the categories listed in the previous section. Finally, because the *Peripheral* paper group covered a broad spectrum of engagement with race, we discuss the different types of papers based on keyword use.

Overall Trends

As illustrated by Figure 1, the proportion of papers including at least one keyword from our list has increased each year since 2019. Specifically, 37% of the reports in the 2024 proceedings

contained at least one keyword compared to the 15.8% seen in the 2019 proceedings. However, we note that this has occurred largely through an increase in Peripheral papers using keywords. From the figure, notice that the rate at which the proportion of Peripheral papers has increased—from 12.0% to 25.3% over six years—surpasses the rate at which the proportion of Core papers has increased—from 0.8% to 5.2% over six years. This suggests that the RUME community has incorporated race more frequently into its reports, but in a way that more often accounts for demographics than providing a focused and substantive discussion of race. The 2022 proceedings had the highest proportion of Core papers seen across the six years (8.3%), about 11 times greater than the lowest proportion seen in 2019 (0.8%). The 2024 proceedings had the highest proportion of Peripheral papers (25.3%) which was about double the lowest proportion (12.03%) seen in 2019. That is, the relative increase between the highest and lowest proportions of Core papers was notably larger than that seen in the Peripheral papers.

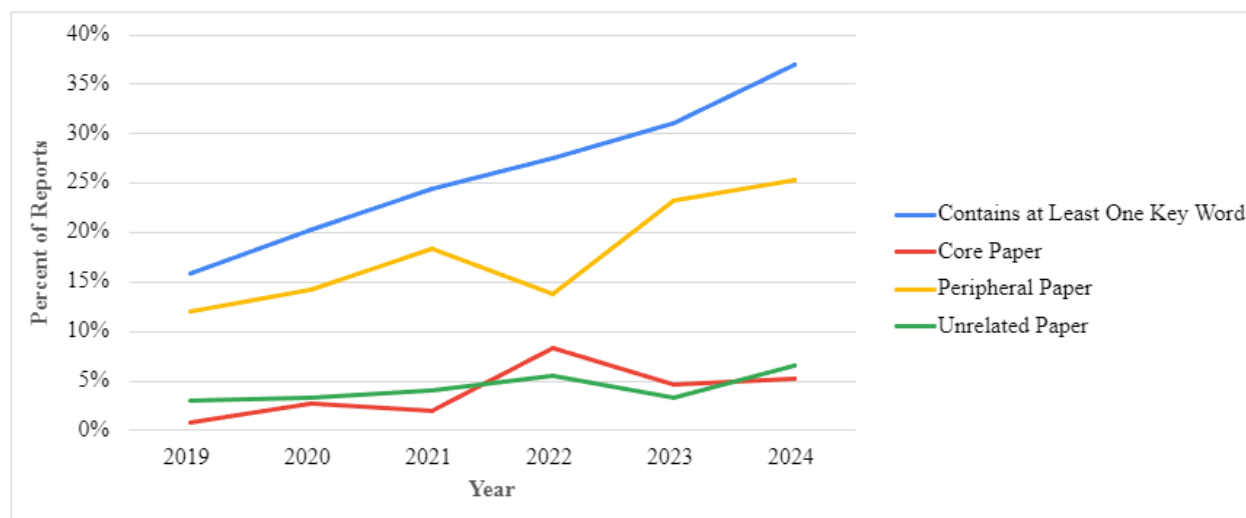


Figure 1: Line Graph of Papers Including Keywords by Focus on Race

Keywords varied by paper type, with some common keywords showing up as the most frequent among Core and Peripheral papers. Table 2 shows the top five most frequent keywords for Core and Peripheral papers. For the Core papers, seven total keywords represented the top five most frequently used; the words *race* and *racial* were present in 81.8% of papers each while *Hispanic* and *White* were present in 66.6% of papers each. You will notice that there are some common words, such as *White*, *Hispanic*, and *Black*, and that these words appeared at different frequencies. For example, in the Core papers, *Black* was the most frequently used keyword, whereas in the Peripheral papers, *White* was the most frequently used keyword. When considering the same keywords, 84.9% of Core papers used the keyword *Black* whereas only 29.8% of Peripheral papers used the same keyword. Notice that the most used keyword for the Peripheral papers is still less used than the fifth grouping of the Core papers. It is expected that the frequencies would be higher in a Core paper given our list of keywords and our selection criteria for how a paper was labeled as Core. It is interesting to note that the Core papers utilize more keywords related to the topic of race (e.g., *race*, *racial*, *racialized*, and *of color*). In fact, we found that keywords one could identify as more aligned with critical work were more highly captured in Core papers. These words include *racialized* (C: 63.6%; P: 8.51%), *racism* (C: 48.8%; P: 5.67%), *Critical Race Theory* (C: 39.4%; P: 2.84%), *racist* (C: 24.2%; P: 1.42%), and *Whiteness* (C: 21.2%; P: 2.1%), where these percentages represent relative frequency ($N=33$ Core, $N=140$ Peripheral).

Table 2: Top Five Most Frequent Words Found in Core and Peripheral Papers.

Core		Peripheral	
	% of Papers		% of Papers
<u>Keyword</u>	<u>with Keyword</u>	<u>Keyword</u>	<u>with Keyword</u>
Black	84.9%	White	49.7%
Race	81.8%	Race	32.6%
Racial		Hispanic	31.9%
Of color	72.7%	Ethnic	30.5%
Hispanic	66.7%	Black	29.8%
White			
Racialized	63.6%		

Core Papers

The Core papers differed in their chosen focus. We found that 13 of the papers (39.4%) focused on the social interactions occurring in classrooms and other spaces; 13 papers (39.4%) primarily focused on the beliefs and attitudes of students and/or instructors. One paper (3.0%) focused on curriculum, two papers (6.1%) focused on student supports, and the remaining four papers looked at other issues including assessments and institutional change. Regarding population of interest, 20 Core papers (60.6%) were centered on students while 13 papers (39.4%) focused on instructors; one of these papers focused on both students and instructors. Most instructor-centered papers (64.6%) looked at beliefs/attitudes while the majority of student-centered papers (65%) investigated issues on social interactions such as instruction.

We found that 22 Core papers (66.7%) included research studies designed around a particular math course or set of courses. These 22 papers were primarily concerned with lower-division mathematics, with 13 papers (59.0%) focused on any level of Calculus and 6 papers (27.3%) focused on Precalculus. Only 3 papers (13.6%) were conducted in upper division mathematics courses, namely Abstract Algebra (2 papers) and Introduction to Proofs (1 paper).

Table 2 shows the theoretical framing found in the Core papers. 29 of the 33 Core papers (87.9%) structured their research around a theoretical framework, whereas four papers did not clearly state a theoretical framework. We found that eight papers (24.2%) utilized critical or

Table 2: Distribution of Core papers by Theoretical Framing Categories

Categories	Example(s)	Frequency
Critical and Cultural Theories	Critical Race Theory, Culturally Relevant Pedagogy, QuantCrit, LatCrit, Community Cultural Wealth	8
Identity	Emerging Mathematical and Racial Identity	6
N/A	No theoretical framing was explicitly stated	4
Other	Theory of Practical Rationality, Servingness	4
Intersectionality	Crenshaw (1991)	3
Institutional	White Institutional Space, DEI Institutional Activism	3
Sociopolitical	Sociopolitical Perspective, Social Capital Theory	3
Microaggressions	Mathematical, Racial, Gendered	2
Equity	Gutiérrez (2009) Four Dimensions of Equity	2

cultural theories (e.g., Critical Race Theory, Culturally Relevant Pedagogy, QuantCrit). The remaining papers implemented a variety of theoretical framings, which can be seen in Table 3.

Twenty-five (75.8%) of the 33 Core papers were coded as using qualitative methods, six (18.2%) used quantitative methods, and one (3.0%) was mixed methods. Twenty-three (69.7%) of the Core papers addressed race in ways characteristic of the Critical axis in Gutiérrez's (2009) framework while 10 (30.3%) papers addressed race in ways characteristic of the Dominant axis, indicating that more papers focused on issues of identity and power, rather than access and achievement. Only one quantitative paper was categorized as critical, where five studies showed characteristics of the Dominant axis. The five papers were coded as dominant because they measured levels of participation/access, graduation rates, and grades which are variables of achievement. The critical quantitative paper drew connections between intersections of students' identities (e.g., race, math) and instructional practices.

Peripheral Papers

Because the Peripheral category was so large, we noticed that there was a broad range of ways that papers focused on race. Table 3 shows the distribution of the focus of race across the Peripheral papers, listed from least to most significant. Notice that most of the Peripheral papers (58.6%) only discussed race/ethnicity in relation to the demographics of the institution, participants, or researchers—a required component of RUME proposals. We do want to note that the highest level, Secondary Focus, contains papers that were on the verge of being labeled Core papers, but because the papers had race as a secondary focus or did not clearly specify race as a focus, they were not grouped as Core.

Table 3: Distribution of Peripheral Papers by Focus of Race in the Paper (N=140)

Focus of Race	Definition	Frequency
Singular Mention	The paper had one or more keywords mentioned in one line of the paper	18 (12.9%)
Demographics	Race/ethnicity only appeared in the demographics of the institution, participants, or researchers	82 (58.6%)
Limited Mention	Mentions of race/ethnicity only appeared in the background, motivation, or future work section	25 (17.9%)
Secondary Focus	Race/ethnicity appeared throughout the paper but was not the central focus	15 (10.7%)

Discussion

The goal of this study was to provide a snapshot of the trends in the race-conscious research in the RUME community. A notable finding was the combination of population of interest and study focus. When the study investigated instructors, it was overwhelmingly to investigate their beliefs and attitudes of a racial topic. While it is important to focus on faculty beliefs and attitudes because beliefs and attitudes impact teaching practices in racialized ways (Park et al., 2024), it has also been shown that an instructors' beliefs may not immediately impact practice in the way one would expect, even if their beliefs align with best practice (Thompson, 1984). Future work could investigate instructors' teaching or assessment practices. When the studies investigated students, the focus was more on classroom instruction, group work, or other ways that we interact within learning. While these are very important areas to research, we suggest also looking into other structures in education, such as placement, course progressions, or

assessment. Other research foci in this analysis were clearly underrepresented within the Core studies. We argue that the learning process is complex and racial bias could manifest itself in localities other than social interactions and teachers' beliefs.

The student populations that were most sampled were students in lower-division courses. Most studies focused on gateway math courses, with a specific emphasis on precalculus and calculus courses. This focus on lower-division STEM mathematics courses is likely due to growing concerns about the retention of underrepresented students in STEM and introductory mathematics classes as gatekeepers in higher education (Brainard & Carlin, 1998; Bressoud, 2014; NASEM, 2016; PCAST 2012). We argue that more work should be done to include other course types. Courses like developmental mathematics, trigonometry, and college algebra also merit attention, as they have been noted as segments of the "leaky pipeline" (Larnell, 2016). Black and Brown students are placed into developmental mathematics courses at higher rates than their peers (Bahr, 2010). While developmental mathematics has been eliminated in states such as California, introductory courses have been replaced with co-requisite models that serve the same group of students (Hernandez & Cawley, 2022), and co-requisite courses merit similar attention to racial inequities. We also notice that upper-division math students are absent from race-conscious studies in the proceedings. We contend that alienation, marginalization, and attrition do not stop once racially minoritized students start taking proof-based courses.

We recognized a substantial divide between the language and terms being used within Core and Peripheral papers. In particular, the use of terms more aligned with critical work like *racist* and *whiteness* point to a substantial critique of norms and structures within mathematics education. While the overall number of studies using keywords increased over time, most of these words appeared more often in Peripheral papers. Through our investigation of Peripheral papers, the increased use of keywords seems to point to an overall increase of including participant or institutional demographic information without engaging with how the demographics inform the research topic at hand. We are unsure if this increase is due to the RUME conference call for submissions requesting that participant/institutional demographic information be included; if so, then the growing number of Peripheral papers indicates some success of this request in motivating contributors to directly name race in their work. However, our analysis here reveals the potential for the RUME community to engage in more substantive engagement with race.

We were inspired to see that a majority of Core papers engaged in research that supported identity and power (Critical axis). Unsurprisingly, we found that qualitative methods were more prominent than quantitative methods among the Critical papers in the Core category, and that quantitative papers focused mainly on issues of access and achievement (Dominant axis). While a focus on access and achievement is still important for racial equity, an overabundance of papers that measure achievement—usually a lack of achievement among racially marginalized students—can lead to a limited view of equity and a deficit view of students. Critical race scholars have argued that quantitative tools can serve social justice purposes when the questions reframe issues to highlight injustice rather than a deficit of students (Crawford et al., 2019).

In all, we found that the RUME community is making great strides to increase focus and awareness of how race exists and is experienced within post-secondary mathematics education. The findings of this meta-analysis identify where we can continue to develop our research such that we contribute more critical work that focuses on issues of race—both in ways that are obvious and others that are more historically engrained within education.

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