

Undergraduate instructor's perceptions of barriers to implementing culturally sustaining practices

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Undergraduate math education is highly inequitable. One potential strategy to improve the unfair experiences and outcomes of historically marginalized groups in mathematics is to use culturally sustaining practices, which relate math content to student's culture and everyday lives. However, there is limited work exploring the applicability of culturally sustaining practices in the undergraduate mathematics setting. This study interviews seven math undergraduate instructors to better understand their perceived barriers to implementing culturally sustaining practices.

Keywords: undergraduate, equity, culturally sustaining practices

Introduction

Undergraduate mathematics education is highly inequitable. Black and Latin* students are frequently weeded out of introductory undergraduate math courses like calculus, prohibiting access to advanced level mathematics courses (Ellis et al., 2016; Larsen et al., 2017). This disproportionate exclusion of Black and Latin* students can result in isolating experiences for the few students who do persist to upper-level courses, who have diminished access to same-gender, same-race peer support (Borum & Walker, 2012).

One potential strategy to ameliorate the differential experiences and outcomes experienced by minoritized groups in mathematics is to relate math content to students' culture, experiences, and everyday lives (Civil, 2016). The framework of culturally sustaining pedagogy (CSP) (Paris, 2012) proposes a step towards equitable instruction that embeds course content in students' lives while providing them with political consciousness. However, there is limited work exploring the applicability of culturally sustaining practices in the undergraduate mathematics setting, with the exception of Adiredja and Zandieh (2020). Since most existing scholarship on CSP has been in the K-12 context, it is unclear the extent to which the same strategies work in the university setting. Thus, in order to better understand how to implement culturally sustaining practices in college classrooms, we might want to understand the barriers specific to the university context.

Accordingly, this study addresses the following research question: What do instructors of math undergraduates perceive to be the barriers to implementing culturally sustaining practices? Addressing this question presents three contributions. First, this work links the expertise gained from scholarship in K-12 equitable practices in mathematics to the undergraduate setting, where we have not taken up as much of the work from our colleagues in K-12. Second, there is little existing work documenting culturally sustaining practices in undergraduate classrooms. This work will explore instructors perceived barriers to implementing CSP. Finally, as Chazan et al. (2016) note, much of the work in mathematics teaching documents instructors' beliefs without considering the influences that institutions and various stakeholders can have on instructors' choices. This work answers Chazan et al.'s call for greater attention to institutional and greater societal context on the choices teachers make.

Literature Review

An increasing amount of scholarship has documented inequitable experiences in college mathematics experienced by Latin* and Black students and students of under-represented genders in mathematics (for a review, see Adiredja & Andrews-Larson, 2017; Leyva et al., 2021; McGee & Martin, 2011).

Leyva et al. (2021) document instructional practices and broader ideologies of mathematics ability (e.g. mathematics ability as innate; white and Asian people are better at math than Black or Latin* students) that create hostile classroom environments for historically marginalized students. While some work has illustrated cases of successful Black (Borum & Walker, 2012) and Latin* (Leyva, 2016) students, I am not aware of work that considers how more equitable instruction interacts with broader institutional and ideological factors. In other words, given various institutional obligations, how far can an instructor go in implementing culturally sustaining practices?

When done well, culturally sustaining practices can encourage critical dialogue, improve student performance on exams, and promote reflection on previously held social assumptions (for a review, see Aronson & Laughter, 2016). Indeed, Hubert (2014) found that students appreciated seeing their home lives reflected in the classroom, which in turn promoted engagement with mathematics content. However, implementing CSP is far from straightforward. Even for those instructors who would like to adopt CSP practices, some struggle with developing authentic connections between school mathematics and students' everyday lives (McCulloch & Marshall, 2011; Wager, 2012).

Unfortunately, there is still little work documenting supportive practices in undergraduate math education that disrupt commonplace racialized and gendered experiences (Leyva et al., 2022). Leyva et al. (2022) document supportive practices intended “for all” students that are necessary yet insufficient to supporting students of historically under-represented groups in mathematics. While instructional practices such as creating space for questions and mistakes and extending out of class support are important, they are limited in their ability to confront the broader influences of racism and patriarchy on classroom experiences. The limitations inherent to practices that do not explicitly address raced and gendered harm in the classroom calls for further work on practices like CSP that do attempt to directly address these harms.

Theoretical Frameworks

Culturally Sustaining Pedagogy

This study uses the theory of culturally sustaining pedagogy (Paris, 2012), reformulated from Ladson-Billings' culturally relevant pedagogy (1995, 2021). Ladson-Billings developed culturally relevant pedagogy based on her studies of effective instructors of African American students. She found that effective instructors accomplished three key objectives, promoting: student achievement, cultural competence, and critical consciousness.

CSP emerged from an acknowledgement that cultural relevance itself is insufficient. Instead, Paris (2012) noted the importance of going beyond curricula that uncritically cite students' cultures towards one that sustains them. As Ladson-Billings (2021) notes, the wide popularization of culturally relevant pedagogy has led to uses and abuses of the theory. As conceptualizations of culturally relevant pedagogy morph over time, the theory changes and gains new subtleties. Culturally sustaining pedagogy combines students' cultural knowledge with the aim of critical consciousness, or an understanding of current sociopolitical realities. In this study, I used CSP to identify a set of recommendations to discuss with college instructors.

Theory of Practical Rationality

To make sense of why my participants would or would not adapt elements of CSP in their teaching, I used Herbst and Chazan's (2003) theory of Practical Rationality of Teaching. The theory considers the different societal and institutional obligations that affect instructors' choices. Chazan et al. (2016) contend that instructors cannot simply do as they please, identifying various obligations instructors must consider: professional obligations, obligations to the discipline of mathematics, obligations to students as individuals, and obligations to society and its imperatives. In this study, I use Practical Rationality to identify instances when different obligations conflict with or support CSP. Like Herbst and Chazan, I make no moral judgments about the choices instructors make in prioritizing certain instructional commitments over others. The theory also does not make any normative judgments about whether an instructor's perceived obligations are truly obligatory. Instead, it is sufficient that an instructor perceives an obligation as relevant to the instructional choices they make.

Methods

Participants were selected among current doctoral students in a mathematics department at a medium-sized public university in the northeast. My participants were PhD students in Mathematics with at least one semester of undergraduate teaching experience as an instructional teaching assistant (TA). I excluded participants who only had experience as grading TAs or whose only teaching experience was prior to starting their PhD. The choice of target population of mathematics PhD students as opposed to current mathematics professors was intentional. First, mathematics PhD students represent the cohort of future college-level mathematics educators. Additionally, as a younger cohort, current mathematics PhD students may be more amenable to CSP practices. While general support of equitable practices is not a requirement to participate in the study, I anticipated that participants would provide far richer insights about the possibilities of equitable instruction if they themselves were invested in such practices.

Data Collection

I invited participants to engage in a single one-hour semi-structured interview about how they might adapt various culturally sustaining practices from the K-12 mathematics context to the undergraduate classroom. The interview was divided into roughly two parts. In each section, I asked the participant to consider a recommendation from New York State Education Department's (NYSED) Culturally Responsive-Sustaining Education Framework. The first section reviewed a selection of the recommendations for making a welcoming and inclusive environment. The second half of the interview discussed practices related to identifying inclusive curriculum and assessment. I picked these themes as they seemed the most relevant and potentially challenging for the undergraduate math context. The remaining themes were: fostering high expectations and rigorous instruction and engaging in ongoing professional learning and support. While there is no agreed set of recommendations for what constitutes CSP in mathematics education (Thomas & Berry III, 2019) the NYSED recommendations provide actionable recommendations constructed by reputable scholars in the field.

Each question opened with an elicitation in which I read one of the NYSED recommendations for culturally sustaining practices in K-12 mathematics to the participant. The participant was then asked the following questions:

1. What are some of the ways you do or could adapt these recommendations to your classroom?
2. Are there any constraints that would make it hard to adapt this recommendation?

3. What kind of resources would you need to implement this recommendation?
4. What factors get in the way of implementing this practice? OR What supports have made these practices possible for you?

Throughout data collection, I engaged in preliminary data analysis via in-process memos in which I pre-coded (Saldaña, 2009) data, documenting any initial impressions or findings.

Coding

Data analysis merged inductive analyses in first cycle coding and deductive methods in the second and third cycles. During the data collection and pre-coding stage, I observed that participants frequently noted moments of conflict in which it became difficult to reconcile certain CSP recommendations with other obligations that they held. I decided to use Herbst and Chazan's theory of Practical Rationality to foreground instructional obligations. To capture these moments of tension and the underlying values that were in conflict, I blended versus and values coding methods (Saldaña, 2009) for my first cycle of coding. I also coded for the various institutional obligations that participants indicated in response to my follow-up questions about barriers to their practice. In summary, the first cycle yielded two categories of codes: codes indicating participants' values, some of which were paired as versus codes, and codes indicating barriers towards CSP practices.

After first cycle coding, I reanalyzed the data using sensitizing concepts (Charmaz, 2014) from the theory of culturally sustaining pedagogy and aligned asset pedagogies. I categorized the values and barrier codes from the first cycle of coding based on their alignment with CSP. By the third cycle of coding, the code corpus consisted of: versus codes indicating tensions between different instructional commitments, values codes that justified instructional moves, and codes aligned with the literature on culturally sustaining practices. However, there were notable tendencies in the ways in which these coding schemes overlapped. Frequently the versus codes contained two different values codes. Furthermore, the values codes could be roughly organized on whether they aligned with culturally sustaining practices. I then used concepts from broader critical theory (e.g. asset-based pedagogies, resource pedagogies) as parent codes to organize the values codes into those that were broadly aligned with CSP and those that were not.

Findings

Conflicting Commitments

In some cases, participants indicated commitments that conflicted with a desire to implement practices that were culturally sustaining. One of the NYSED recommendations advised instructors to implement restorative justice circles to address harm done in the classroom. Restorative justice is an alternative that focuses on redressing harms caused instead of punishing the offender. I provided a brief description of restorative justice and offered academic dishonesty as an example of a potential harm. I then asked how participants could make sense of this recommendation in their own practice and any supports they would require. In response, one participant, Michael, indicated:

Going along the lines of the example that you gave, the professor needs the flexibility to be able to adjudicate these things on their own. At [this university], we have a great bit of discretion, as TAs or as professors, about how we handle instances of academic integrity. So at [this university], the structure is actually pretty fertile for us to do this sort of thing. But at other institutions, they are very, very, very strict. To give an example, [at other university] ... I am pretty sure that if you cheat on the exam, they just expel you. [...] So in order to allow [for restorative approaches], you need to have this discretion, because

otherwise it's simply impossible. You don't want to be in a situation where common sense or sympathy as a human being is telling you, "look, I can handle this in a better way." But you have your own job to be concerned with, and, unfortunately, if they're going to come after you if you do something, regrettably, you're gonna have to do what's in the interest of your job.

Michael indicated that professor discretion was necessary in order to implement a restorative approach to academic dishonesty. Ultimately, even if an instructor's "common sense or sympathy" led them to favoring a restorative approach, the possibility of institutional repercussions could require one to "do what's in the best interest of [their] job." I interpreted Michael's reference to common sense or sympathy as his perceived obligation to the student conflicting with his professional obligations to abide by institutional rules. From Michael's perspective, attempting to adopt the culturally sustaining pedagogical practice of restorative justice may be rendered an impossibility depending on institutional factors.

Like Michael, Owen described institutional obligations that impeded his ability to implement CSP. In reference to the recommendation to build rapport with students and elicit their opinions and concerns, I asked Owen what constraints he felt in adopting the recommendation. He noted that the institutional requirement of having to escort students to the bathroom during exams and practice of failing 30-40% of business students taking calculus make it difficult to build rapport with students. He mentioned apologizing to students to push back against these constraints. He empathized with the business students and recalled attempting to push back against institutional practices:

And I think I did do that one day. I think I do try to bring this up sometimes like, "I don't want you to be judging yourself over what happens in the classroom. Because that's sort of what's going on. You're getting grades and you're going to get into this school or not and be allowed to go on or not. And that's stupid and frustrating. I don't believe in it." I don't think that's a huge affront to the system. I think it'd be much more dangerous to start criticizing the professor. I mean, not that I'm opposed to that, but I'm just saying. You can get fucked up for that. And the other thing is also, in terms of like maintaining rapport, you don't want to tell somebody what they're doing is pointless or stupid...

Owen felt it was hard to build rapport with his students if he had to patronise them by walking to the bathroom or punishing them with bad grades. Interestingly, one of Owen's perceived commitments appears to be the disruption of the very institutional practices that hinder student autonomy and obstruct CSP. While following his professional obligation to follow the professor's instructions and escort the student to the bathroom, he also attempted to abide by his obligation toward the student by making a joke about the situation and apologizing to them.

In Michael's case, he felt that institutional barriers could obstruct his attempts to follow CSP practices. If it came down to choosing between making the best professional decision or acting out of sympathy towards the student, he felt that one must choose what's in the best interest of their job. On the other hand, Owen, by apologizing to students or directly calling institutional practices "stupid and frustrating," described methods for subverting institutional barriers in favor of aligning with more CSP-like practice. For Owen, the presence of

constraints against student agency seemed to generate novel obligations to acknowledge the constraints and be candid with students.

Limited knowledge of how to implement culturally sustaining practices

In some cases, participants indicated that their lack of knowledge of how to properly implement certain culturally sustaining practices served as a barrier. One of the presented recommendations is to “feature and highlight resources written and developed by traditionally marginalized voices that offer diverse perspectives on ... identities traditionally silenced or omitted from curriculum” (New York State Education Department, n.d.) In response, Max commented:

The main thing that prevents me from doing this is that I don't put enough time into it. If I'm preparing for class, I'm mostly thinking about how to explain—I'm gonna use the example of derivatives again—rather than looking back and saying “can I find a useful historical example of a woman or disabled person who contributed to this area?” and highlight that. I've had a couple of professors who have taken extra time to highlight, for example, women who have contributed to an area of math that we're learning about and I've enjoyed that part. It's always nice when there's a little break in the lemma-lemma-theorem-proof structure to talk about history. That's definitely enjoyable, but it's just extra effort for the professor. [...] I try to set pretty high honesty requirements of myself, and I'm not a historian. So one constraint would be I want to tell my students the truth about what happened and what was important in the history of math. I guess that just adds to the amount of time it would take as input to make this work well is that I don't want to just read a BuzzFeed article about Mayan mathematical practices and just quote that without understanding what I'm really talking about. [...] If my PhD had a requirement to take a math history class to graduate, then I would love that, and I would know a lot more about that by the time I was teaching it.

Max appears to be supportive of the recommendation, recalling previous “enjoyable” experiences in which professors highlighted historical context in their courses. While he does refer to this work as “extra effort” by the professor, he later indicates that he would appreciate having a requirement embedded in his PhD program to take a math history course. While Max may not view this recommendation as essential, he appears open-minded towards it. However, Max mentions that the amount of time it would take to fully research and understand historical examples of the work of under-represented mathematicians would be substantial. Part of his hesitance stems from wanting to present historical content accurately and his awareness that he may lack the sufficient background knowledge as he is “not a historian.”

While Max does open by citing time as a primary constraint, these instances appear to be rooted in the time it would take for Max to prepare and learn any material on his own. He closes by mentioning a previous course in his PhD program would alleviate some of his concerns. It appears that Max's commitment towards presenting material accurately conflicts with the recommendation to include under-represented perspectives in mathematics, given the lack of prior knowledge that PhD students like Max tend to have.

Discussion

The data support two main claims. First, instructors perceive various commitments that may conflict or align with culturally sustaining practices. Second, instructors also indicate that a lack

of knowledge of how to properly implement certain CSP practices serves as a barrier to implementation.

In their work documenting the limitations of “for all” practices, Leyva et al. (2022) argue that equitable instruction must also directly confront broader racialized and gendered discourses that permeate mathematics classrooms. If we are to ask instructors to directly subvert institutional ideologies, it would be crucial to understand the various perceived commitments instructors may be balancing as employees of an inequitable institution. Regardless of whether these commitments are commonly perceived or even misplaced, these commitments serve as barriers to instructors who may desire to implement equitable practices but feel unable to.

Previous work described a need for instructors to have deep pedagogical content knowledge (Enyedy & Mukhopadhyay, 2007) as well as knowledge of how students use mathematics in their everyday lives outside of school (Wager, 2012). This data suggests that instructors also felt a lack of historical knowledge about mathematics as a discipline provided a barrier to enacting CSP effectively. The instructors perceived institutional obligations and obstructions even when armored with appropriate training and knowledge would be an interesting direction for future research.

This study explored the question: what do instructors perceive to be barriers to implementing culturally sustaining practices? Interviews with seven math doctoral students who have taught undergraduates, revealed two main findings. Instructors balance conflicting obligations, some in service of culturally sustaining practices and others that directly conflict with CSP. Second, instructors expressed insufficient knowledge and training to implement some CSP practices. Given the need for instructors to disrupt institutional discourses about mathematics, it is important to better understand how instructors may operate and balance conflicting commitments to equitable practices and to the institution to which they are accountable. Furthermore, this work is part of a larger call to situate instruction in its institutional context (Chazan et al., 2016) and potentially understand the possibilities for instructional disruptions given inequitable institutional contexts. Previous literature (e.g. Leyva et al., 2022) has viewed oppressive ideological and institutional influences in tandem with instructional ones. One potential route for further work would be an understanding of the mechanism behind instructional disruptions and how they interact with racialized and gendered institutional and ideological discourses. For example, if an instructor effectively provides counter-narratives against a discourse that mathematics talent is innate, what are the limitations and affordances of a single instructor doing this amidst an institution that continues to perpetuate the dominant discourse?

Limitations

This study presented only a narrow slice of the many perspectives instructors might hold. Of our participants there were: four white men, one Asian man, and two white women. It is possible that the types of responses we would have received would have differed had our sample population included more participants of under-represented identities in mathematics. However, generalizing to the population of future professors was not the goal of this study. Additionally, there is a possibility, using a different theoretical lens, that instructors did not truly perceive the obligations they shared with me as legitimate concerns and instead used them as part of a rhetorical strategy to uphold systems of white supremacy in mathematics (e.g. Bonilla-Silva, 2001). While this may have been the case for any of the participants, I argue that it is nonetheless valuable to understand the types of commitments instructors indicate may be in conflict with equitable practices such as culturally sustaining pedagogy.

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