

## EMPIRICAL ARTICLE

# Taking a critical participatory action approach to education measurement development

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## Funding information

National Science Foundation, Grant/  
 Award Number: 2200437; Overdeck Family  
 Foundation

## Abstract

This study examines how critical participatory action research (cPAR) can advance education measurement development by positioning Black and Latino students and their teachers as co-researchers. As part of the Adapted Measure of Math Engagement (AM-ME) Project, a three-year partnership with a school district in the Midwestern region of the U.S., students, teachers, and academic researchers collaboratively defined math engagement, co-created survey items, analyzed qualitative evidence, and developed practice recommendations. Drawing on reflections, artifacts, and action-planning products from the AM-ME Research Group, findings show that participation fostered new researcher identities for students and teachers, strengthened cultural responsiveness and methodological rigor, and generated actionable classroom and district strategies. The project highlights how embedding cPAR into measurement development may produce more credible and culturally grounded instruments and cultivate youth and teacher agency while directly informing educational practice. These results highlight the potential of participatory methodologies to bridge research and practice and to expand how developmental and educational sciences conceptualize student engagement.

## KEYWORDS

critical participatory action research, culturally responsive teaching and learning, math engagement, measurement

## INTRODUCTION

Developmental and educational sciences have evolved meaningfully in the recent decades to better address the strengths and needs of an increasingly diverse population of youth (e.g., Causadias et al., 2023; Lerner et al., 2021; Marks & Garcia Coll, 2018; Santoro, 2023). However, youth from marginalized backgrounds in the U.S., including Black and Latino youth, remain relatively invisible in much of the developmental and educational science literature (Kumar & DeCuir-Gunby, 2023; Syed et al., 2018). When they are represented, these youth are too often examined from a deficit-based perspective, for example, described as “underachieving” or “disengaged” instead of being understood as failed by systems that disadvantage them (Ladson-Billings, 2006; López, 2022; McMahon & Portelli, 2004). Part of this invisibility and narrow framing can be attributed to a lack of methodology that authentically centers the lived experiences of youth from marginalized backgrounds. To address this gap, this paper discusses a

critical participatory action research (cPAR) approach in working with Black and Latino middle and high school students and their math teachers to develop a culturally responsive self-report measure of math engagement. The focus of this paper is not on the project's research findings per se; rather, we showcase lessons learned from applying cPAR as a methodology.

## Moving from research *on* to research *with*

Critical participatory action research (cPAR) is a form of community-engaged research (Kemmis et al., 2013). The rise of community-engaged research could be seen as a direct resistance and rebellion against the historical way of doing research that has been extractive, if not exploitative, of youth and adults from marginalized backgrounds (Kemmis et al., 2013; Smith, 2021). In other words, community-engaged research is a paradigm shift from doing research *on* or *for* youth and adults to doing

research *with* youth and adults (Chevalier & Buckles, 2019; Langhout & Thomas, 2010). The foundation of cPAR is a belief that those served by research should participate in designing research questions, methods, analyses, interpretations, and action planning (Torre et al., 2012). The critical aspect encourages research to better serve those not benefiting from current practices (Fine & Torre, 2021). See Table 1 for a summary of how we define cPAR, as well as a few other key terminologies, in this study.

Participatory action research methodologies, including cPAR, have been used for a variety of disciplines and research topics, such as social work, public health, education, social policy, and youth activism and organizing (Anyon et al., 2018; Fox et al., 2010; Sandwick et al., 2018; Schmidt-Sane et al., 2023). However, cPAR has not been widely adopted by measurement development research, which traditionally does not partner directly with users (e.g., teachers and students) to intentionally shift practice (Kemmis, 2006). Addressing this gap, our study's cPAR methodology challenges conventional researcher-led models by positioning students and teachers as active contributors of measurement development.

## cPAR with youth from marginalized backgrounds

The collaborative design of cPAR is meant to deepen the cultural relevance and validity of the research findings, making it a particularly meaningful methodology for understanding the lived experiences of youth from marginalized backgrounds, which was the primary focus of this work (Rodríguez & Brown, 2009). Essentially, involving youth from marginalized backgrounds throughout the research process helps ensure that the ultimate research findings are meaningfully grounded in their experiences and perspectives. A participatory action research project on school mental health, for example, showed that Latino youth co-researchers brought critical and meaningful perspectives by expanding the understanding of the issue to include its cultural roots (Smith et al., 2024).

While the developmental and educational sciences have seen an uptake of community-engaged research, more studies are needed to understand and document how youth from marginalized backgrounds derive value from participating in this process. Prior studies showed that through participatory

action research, youth reported skill development and a range of positive outcomes such as social-emotional competencies, sense of empowerment, critical thinking, leadership, familiarity and appreciation for data, and expanded educational and career aspirations (Anyon et al., 2018; Leman et al., 2025; Wagaman et al., 2023). Contributing to this growing body of research, the central goal of this paper is to describe the process and lessons learned from our cPAR project.

## METHODS

### Study context

This study is part of the Adapted Measure of Math Engagement (AM-ME) Project, a three-year study to develop a culturally responsive measure of math engagement that centers the lived experiences of Black and Latino middle and high school students. We use “Latino” as an umbrella term for people who identify as Hispanic, Latino/x/é, or Spanish origin. We acknowledge that the term “Latino” might not resonate with every individual categorized in this group, including those who hold a nonbinary gender identity. The project was conducted as a partnership between three nonprofit research organizations and a school district located in the Minneapolis-St. Paul metropolitan area in Minnesota within the United States. All three middle schools (one is predominantly attended by White students, one is racially/ethnically diverse, and one is predominantly attended by students of color) and two high schools (one is predominantly attended by students of color, the other is predominantly attended by White students) in the district participated in this project. We used a cPAR design in which students, teachers, and academic researchers co-led all phases of the project, including defining engagement, planning data collection, developing items, and creating dissemination products (Kemmis et al., 2013). All study procedures, including the student and teacher co-researcher involvement, were approved by an Institutional Review Board (IRB#:FWA0005835). Parental or guardian consent and student assent were secured for all students participating in the AM-ME Research Group. This project was funded by the National Science Foundation (#2200437) and the Overdeck Family Foundation.

**TABLE 1** Key terminologies defined.

Key terminology	As defined in this study
Critical participatory action research	A form of community-engaged research that is grounded in the belief that those served by research should participate in designing research questions, methods, analyses, interpretations, and action planning. The critical aspect encourages research to better serve those not benefiting from current practices
Measurement development	A systematic, multi-stage, and iterative process of creating, refining, and validating survey scales to validly measure specific, often abstract, concepts (e.g., math engagement in this case)
Culturally responsive	Recognizing, validating, centering, and/or uplifting the cultural backgrounds, knowledge, and lived experiences of marginalized youth/communities

## The AM-ME research group

Central to this project's design was the AM-ME Research Group, which included seven academic researchers, five math teachers, and six Black and Latino students. Principals nominated teachers (who must provide math instruction, due to the study's focus on math engagement) to participate, and teachers then nominated students. The teachers were reminded that the study goal was to understand math engagement in a way that centers the lived experiences of Black and Latina/o students, thus the students they nominated must identify as Black and Latina/o, and that the variety of students' experiences and feelings toward math were important to consider (i.e., we encouraged teachers to identify students who they may traditionally consider disengaged). As shown in [Table 2](#), our teacher and student representatives indeed brought a diversity of lived experiences and perspectives toward math. There was a teacher and student representative from each of the middle and high schools participating in the overall study.

Each student and teacher co-researcher received a \$4000 stipend per year, which was an intentional effort to support sustained participation for teachers with competing priorities and students from marginalized backgrounds. Other intentional efforts to support sustained participation include: providing transportation to the in-person AM-ME Research Group meetings, which were hosted at one of the participating schools to minimize travel distance, and bi-monthly one-on-one meetings with student and teacher co-researchers to further build relationships and discuss our shared work.

Participation evolved slightly over time to ensure school representation and to accommodate student transitions. One student left the AM-ME Research Group after the first year as she transferred to a new school; we added a student in the second year to replace this student, and we added another student in the final year to balance school representation. In the final year, as the group shifted its focus toward translating research findings into actionable changes, two district staff members joined to provide policy-level perspectives. See [Table 2](#) to learn more about the AM-ME Research Group members.

## Researchers positionality

Taking a cPAR approach calls for equitable participation from the various participants, which makes positionality centrally important (Kemmis et al., 2013). This study was a team effort, and we were mindful of the perspectives each of us brought to the research and how this shaped our interpretation. Although academic researchers carried out the bulk of data coding and analysis, students and teachers were integral in member checking and interpretation, which strengthened the credibility and trustworthiness of the findings.

All student co-researchers identified as Black and/or Latino and brought lived experiences, particularly their racialized experiences in math classrooms. Although they were nominated by their math teachers to join the project, they held varied relationships with math. Some students described math as their favorite subject, while others reported that they had not liked math initially (see [Table 1](#)).

The five teacher co-researchers identified as White. They brought extensive classroom experience and practitioner wisdom to the study. They regularly acknowledged that their own educational backgrounds and experiences with learning math were often different from those of the Black and Latino students they taught.

The seven academic researchers are identified as White, Asian, or Multiracial. Most had no prior connection to the partnering school district, and each acknowledged that their racialized and cultural experiences with math differed from those of the student and teacher co-researchers. The academic researchers contributed methodological expertise, including qualitative inquiry and psychometrics, as well as content expertise in engagement and math learning.

## Data sources

The data for this project were drawn from a wide range of artifacts that documented the work of the AM-ME Research Group over 3 years. These sources included meeting materials such as agendas, slides, and training documents, which provided insight into the structure of the sessions and the strategies used to build shared understanding across students, teachers, and academic researchers. Researcher notes and transcripts from group discussions documented the dynamics of collaboration and illustrated how the AM-ME Research Group worked together to process and analyze the data generated through the project. In addition, student and teacher co-researchers completed multiple forms of written reflection throughout the project. These included exit tickets at the end of each meeting, end-of-year check-ins, individual reflection letters, and final project reflections. Together, these sources offered a window into how student and teacher co-researchers experienced the cPAR process, how their thinking evolved over time, and how they made sense of their own roles in the project.

Toward the end of the project, artifacts and notes were generated during action planning activities, in which the AM-ME Research Group worked in small groups to develop recommendations for classroom practice and district-level change. These activities resulted in worksheets, summaries, and recommendations that documented student and teacher co-researcher ideas and showed how they envisioned applying the research findings in practice. Taken together, these diverse sources created a robust qualitative dataset that reflected both the process and outcomes of the project, allowing us to examine how student and teacher co-researchers experienced and shaped the collaborative research process itself.

**TABLE 2** AM-ME research group members.

Name	Grade	Gender	Race/ethnicity	Do you like math?
<b>Students</b>				
Brianna	8	Female	Black and White	Not initially, but likes learning about math
Serrah	8	Female	African American	Yes, math is her favorite subject. Likes math for being a common language, for having different ways to do math and can be creative to in getting a correct answer
Antonio	9	Male	Half American/Half Mexican	Used to like math a lot more than now because now it is a lot tougher
Diamond	11	Female	Black	Prefers math to reading and other subjects
Aubrey	8	Female	African American	Yes, because it is easy to understand from multiple points of view
Ryan	9	Male	Black	Not applicable (N/A)
Salma	12	Female	Black	N/A
<b>Teachers</b>				
Name	Grade taught	Gender	Race/ethnicity	Do you like math?
Karina	Middle school	Female	White	Loves math for its order and structure
Ashly	Middle school	Female	White	Loves math and has always loved math
Karla	Middle school	Female	White	Loves math and likes when the light bulbs go off for students
Kathleen	High school	Female	White	Always liked math, wants to work through problems rather than read or write a paper
Nate	High school	Male	White	Loves math
Name	Research role	Gender	Race/ethnicity	Do you like math?
<b>Academic research staff</b>				
Samantha	Principal investigator (PI)	Female	White	Never liked math! Always found it challenging
Diane	Co-PI	Female	Asian	Likes math as a way of thinking
Alyssa	Research support	Female	White	It is complicated. Identifies more as a words person, but good at math in school
Mark	Co-PI	Male	Asian and Pacific Islander	Loves how math is everywhere, including in nature
Marisa	Co-PI	Female	Multiracial	Love math because loves solving puzzles. Wishes she was better at it
Claire	Co-PI	Female	White	Enjoys math a lot and has uses it every day as part of her job!
Olivia	Research support	Female	White	Like it when it is practical, but dislikes it when it feels abstract

*Note:* Student grade levels are reported as of the start of the project (Fall 2023). The question “Do you like math” was asked at the beginning of the project, or at the time someone first joined. Aubrey left the AM-ME Research Group after 1 year, and Ryan joined the group as a result. Salma joined the AM-ME Research Group in the third year to ensure representation from the two high schools. District staff are not included in the table because they joined the project midway through the third year, and the available data do not adequately capture their experiences.

## Data analysis

An iterative process that combined inductive and deductive coding was used to analyze the qualitative data (Creswell & Poth, 2016). Our analysis sought to address three central research questions: (1) how student and teacher co-researchers experienced participating in the cPAR project, (2) how their participation strengthened the quality and cultural responsiveness of the research and (3) how their participation informed recommendations for shifts in education practice and understandings of Black and Latino students' math engagement.

First, an inductive review of the full set of data, which included meeting agendas, slides, training materials, researcher notes, transcripts, reflection activities, exit tickets, individual letters, and action-planning products, was conducted. Three academic researchers open-coded a subset of documents to capture excerpts related to participant experiences, research processes, and practice implications (Creswell & Poth, 2016). From this analysis, a preliminary set of codes that aligned with our research questions was generated: student and teacher co-researcher experiences, research quality and cultural responsiveness, and classroom practice.

**TABLE 3** Action points for using critical participatory action research approach.

Action point	Description
Conducting critical participatory action research	<ul style="list-style-type: none"> <li>• Build understanding of the research process by providing hands-on opportunities, e.g., learning to interview, develop survey questions, analyze data, and present findings.</li> <li>• Create a supportive, welcoming, and affirming environment where students and teachers felt equally valued.</li> <li>• Build trust and rapport as a foundation for collaboration; even small practices, such as providing food, and opening meetings with games, can go a long way.</li> <li>• Center student and teacher co-researchers' perspectives and inputs in guiding the research process, e.g., encouraging their interpretation to surface cultural factors that might otherwise have been overlooked.</li> <li>• Increase the accessibility of complex research tasks, e.g., breaking up long coding tasks into smaller chunks, using visual tools to make data analysis easier to follow, how having structured agendas and prework.</li> <li>• Engage student and teacher co-researchers regularly in the member checking process, e.g., generating early codes, reviewing emerging themes, participating in data gallery walks.</li> <li>• Empower student and teacher co-researchers to translate research insights into practical strategies and recommendations for change.</li> </ul>
Support sustained participation	<ul style="list-style-type: none"> <li>• Provide equitable stipend for both student and teacher co-researchers (\$4000 stipend per year in our case).</li> <li>• Provide transportation to in-person meetings.</li> <li>• Host in-person meetings at locations that minimize travel distance (e.g., at one of the participating schools in our case).</li> <li>• Host bi-monthly one-on-one meetings with student and teacher co-researchers to build relationships and discuss our shared work.</li> <li>• Remind students and teacher co-researchers that their contributions matter.</li> <li>• Intentional practices that normalized respect and reciprocity.</li> </ul>

Building from these codes, a codebook informed by both emergent insights and existing literature on cPAR, community-engaged research, student voice, and culturally responsive practice was created (Creswell & Creswell, 2017). Codes included constructs such as empowerment and agency, relational trust, shared authority, cultural responsiveness, and recommendations for education practice shifts. Three academic researchers then deductively applied the codebook across the dataset using Dedoose (Salmona et al., 2019). Each segment of data was double-coded by three team members, and discrepancies were resolved through discussion to ensure the dependability and thus trustworthiness of our interpretation. We maintained an audit trail of coding decisions, and discrepancies were resolved through discussion until consensus was reached. Finally, the excerpts under each code were reviewed to develop narratives that describe our themes of main findings.

Throughout the process, we integrated member checking by sharing preliminary interpretations with student and teacher co-researchers during meetings. Their feedback shaped code refinement and theme development, which increased the credibility and thus trustworthiness of the findings. This analytic approach allowed us to trace how student and teacher co-researchers described their experiences in the research group, how they perceived the research process as strengthened through their involvement, and how they connected the project to concrete recommendations for shifts in teaching and learning practices for Black and Latino students.

## RESULTS

This section presents findings organized by our three research questions. Across all analyses, student and teacher co-researchers described how participation in the AM-ME Research Group shaped their personal and professional

growth, deepened the quality and cultural responsiveness of the research, and informed concrete recommendations for shifts in practice. Throughout this section, we center the voices of the student and teacher co-researchers by describing how their voices shaped the research process and using direct quotes from transcripts. All student and teacher identifiers were removed from these sections to maintain their confidentiality. See Table 3 for a summary of action points for using a critical participatory action research approach that came out of this study.

### Understanding student and teacher co-researchers' experiences engaging in cPAR

Overall, both student and teacher co-researchers described their participation in the AM-ME Research Group as empowering, meaningful, and transformative. Their reflections revealed three primary areas of impact: developing an understanding of the research process, creating a supportive environment, and sustaining their engagement. Students emphasized that their voices were heard, valued, and essential to shaping the project. Teachers reflected on the opportunity to learn alongside students, which they viewed as rare in their professional roles. Across both groups, student and teacher co-researchers reported growth in skills and confidence, a deeper understanding of research and engagement, and stronger relationships with one another. Their accounts reveal how participation in a cPAR project reshaped their views of research and their sense of themselves as agents of change in education.

### Building understanding of the research process

One of the strongest themes across student and teacher co-researchers' reflections was the shift in how they saw

themselves in relation to research. Students entered the project largely unfamiliar with research processes, often assuming that data collection and analysis were tasks reserved for professional researchers. Over time, however, they began to understand the research process and their engagement with it in a different way. Students described learning to interview, develop survey questions, analyze data, and present findings. They saw these skills as not only technical but also relational. For example, one student explained that learning how to conduct interviews gave them confidence to “talk to adults” outside of school settings. Another described the painstaking work of crafting survey items, noting that it was “a long process” that required multiple rounds of revision. This recognition of the complexity of research gave students a sense of accomplishment and pride. As one student put it, “Way more work is inside surveys, data, presentations than you can see or you thought.” That sense of insider knowledge helped them gain an understanding of how education research is conducted and the rigor that goes into it.

Teachers also described shifts in understanding research, though in somewhat different ways. While they already saw themselves as professionals with a general understanding of research, many had not previously conducted research themselves. Their reflections emphasized surprise at the rigor and iteration involved in research. One teacher commented, “How much went into a survey, looking at them in multiple different ways many different times... re-wording questions and thinking about how different people can interpret it takes a lot of work.” Teachers consistently articulated a new appreciation for research and for the collaborative approach that cPAR requires.

Together, these reflections suggest that the project created space for both students and teachers to develop a new appreciation for research. For students, this meant moving from being research subjects to becoming deeply aware of the research process. For teachers, it meant expanding their role as practitioners to include conducting research in partnership with students and academic researchers.

### Creating a supportive environment

Another defining feature of student and teacher co-researchers' experiences was the relational environment of the AM-ME Research Group. Students consistently described the group as welcoming, supportive, and affirming. For some, this was the first time they felt their perspectives in school were taken seriously. One student explained, “The environment was welcoming and made me feel like my voice and thoughts mattered.” Another noted, “It was fun to learn about where other people are coming from. Some of us have been through the same scenarios, so it's important to hear other people's stories.”

Teachers echoed the importance of relationships, both in how the group operated and in what it modeled for classroom practice. They described the group as more affirming

than traditional professional development, where teachers often feel judged or talked down to. As one teacher reflected, “All our meetings made me feel great, as opposed to other professional development that kinda made people feel dumb.” Another emphasized the value of hearing student perspectives directly, describing it as “a really rare opportunity” that deepened their understanding of how students engage in math.

These relational dynamics were central to the project's impact. By creating an environment where students and teachers felt equally valued, the AM-ME Research Group modeled the type of supportive, inclusive spaces students and teachers wanted to see replicated in classrooms. Even small practices, such as providing food or opening meetings with games, were highlighted by students as important ways of fostering belonging. Teachers, too, described how these practices reinforced the importance of building trust and rapport as a foundation for collaboration.

In this way, the group's culture of care and mutual respect became both a condition for and an outcome of participation. Students and teachers carried these relational insights back to their schools, viewing them as essential for supporting engagement in math.

### Maintaining motivation for sustained engagement

Given the project's multi-year timeline, the fact that students and teachers remained actively engaged is notable. Only one student left the AM-ME Research Group because she switched schools. Their reasons for sustained participation shed light on what makes cPAR meaningful and sustainable. For students, motivation was often tied to the belief that their contributions mattered. One explained that they continued because they believed “this work will make a difference.” Another said, “Because I genuinely started to care about seeing changes.” Students valued the outcomes of the project and the process, particularly the opportunity to learn from peers and teachers across schools.

Teachers described their motivation as rooted in professional values. They saw the project as directly relevant to their practice and as an opportunity to better support Black and Latino students. One explained, “I hope to see Black and Latino/a students more engaged after putting thought into how I build student-teacher relationships, classroom culture, and students' math identity.” For teachers, then, the project was not extra work but a meaningful extension of their commitment to equity in education.

At the same time, both groups acknowledged the importance of recognition and tangible support. Students mentioned that participation was valuable for college applications and appreciated the stipends they received for their time. Teachers noted that stipends, food, and structured meeting times helped make participation feasible. These practical considerations reinforced student and teacher co-researchers' sense that their time and expertise were valued, which in turn sustained their commitment.

Taken together, these reflections suggest that motivation in cPAR is multidimensional. It is sustained not only by intrinsic factors, such as believing the work is meaningful, but also by structural supports that acknowledge student and teacher co-researchers' work.

### Strengthening the quality and cultural responsiveness of the research

Student and teacher co-researchers contributed to strengthening the research in three main ways: by ensuring the measure reflected students' lived experiences, by strengthening the research process through their own practices, and by engaging in member checking that enhanced the credibility of the findings. Across these areas, their participation helped shift the research from being *about* students to being *with* students, which improved both its methodological rigor and its cultural relevance.

#### Making the research culturally relevant

Students and teachers shaped how math engagement was defined and assessed, which made the adapted measure more relevant for Black and Latino students. Without their involvement, the research might have relied on narrow or generic definitions of engagement that emphasized compliance, such as paying attention or completing homework, rather than cultural and relational dimensions. For example, during a review of survey items, students and teachers observed that none addressed how instructional practices reflected students' identities, backgrounds, and interests. Because this notion about students' identities, backgrounds, and interests surfaced frequently in student focus groups and teacher interviews, they emphasized its importance and developed a new set of items to capture it. Therefore, they wrote this group of items: (1) my math teacher takes time to understand me; (2) my math teacher takes time to understand my culture; and (3) my teacher uses examples related to my interests to teach math. Through their contributions, engagement was reframed as more contextual, including relationships, family support, and a sense of belonging.

Students stressed that relationships with teachers and peers were central to how they experienced engagement. One explained that "having a good relationship with the math teacher is very important because it helps you feel confident." Teachers reinforced this perspective, noting that their participation in the group confirmed the importance of relationships and helped them broaden their view of what engagement looks like. As one teacher described, "Previously I thought math engagement was simply doing the work, handing it in. Now, I really think about how different resources, like family [and] community, play a part in math engagement."

This process also helped surface cultural factors that might otherwise have been overlooked. Students emphasized that survey questions must capture their lived realities and be accessible across languages and experiences. In one small group reflection, student co-researchers noted that "familial support and barriers are important to math engagement and confidence." By integrating these perspectives, the survey avoided deficit framings and instead reflected student strengths and challenges within their broader cultural contexts.

#### Strengthening the research process through co-researcher practices

Students and teachers did not just participate in the research; they actively shaped *how* the work was conducted. Their involvement revealed concrete strategies that improved the rigor, inclusiveness, and efficiency of the research process. For example, students frequently suggested revising activities so that they were more accessible, such as breaking up long coding tasks into smaller chunks or using visual tools, like Miro, to make data analysis easier to follow. Teachers highlighted how having structured agendas and prework supported participation across busy schedules, noting that these practices helped them come prepared to engage with the data in meaningful ways.

In addition, student and teacher co-researchers helped refine the technical aspects of measurement development. Students pointed out when survey items contained language that was confusing or culturally misaligned, which led to wording changes that improved clarity and relevance. For example, students changed the wording of "I see myself as someone who can be successful at math" to "I think I am good at math." Teachers contributed by identifying items that could be misinterpreted in classroom contexts, ensuring that the measure would be usable by practitioners. For example, there was a question about students completing their math homework; however, teachers noted that they rarely assign homework. One teacher reflected, "I learned what makes a good question and proactively how many ways it can be interpreted."

Through these contributions, student and teacher co-researchers strengthened the process by making it more adaptive, transparent, and grounded in the realities of classrooms. Rather than following a rigid research plan, the project evolved through these iterative adjustments, demonstrating how cPAR can enhance methodological quality by embedding participant expertise into the design and implementation of research activities.

#### Enhancing credibility through member checking

Students and teachers also contributed directly to the credibility and thus trustworthiness of the study by engaging in member checking throughout the research

process. Rather than treating data interpretation as the sole responsibility of academic researchers, we involved the student and teacher co-researchers in conducting qualitative data analysis by generating early codes and reviewing emerging themes. This step allowed student and teacher co-researchers to validate interpretations, add nuance, and point out where academic researchers' understandings missed the mark. Additionally, students and teachers engaged in data gallery walks, reviewing the results of the exploratory factor analysis, confirmatory factor analysis, and Rasch analysis, and offering their perspectives on the results.

In the beginning, several students and teachers were particularly vocal about pushing back on oversimplified interpretations of engagement. For example, during check-ins, one teacher noted that equating engagement with visible participation overlooked students who are quiet but deeply invested in their work. This feedback corrected potential bias and expanded the construct of engagement in ways that increased validity. Students further corrected language in survey items and emergent themes from qualitative data that did not reflect their lived realities, prompting revisions that made the measure more accurate and culturally responsive. For example, students noted that most of their schools did not offer afterschool programs to support math learning. In response, an item originally focused on school-based afterschool programs was broadened to read: "Adults outside school give me math resources like afterschool programs or tutors."

The process of member checking also fostered a sense of ownership over the findings. Students expressed pride in seeing their perspectives represented, with one reflecting, "I felt that throughout this journey my thoughts and voice was heard and never misunderstood." Teachers similarly described how reviewing and revising codes alongside students deepened their trust in the process, noting that it "gave me data from groups of students about what works and doesn't work." These examples show that credibility in cPAR is about integrating co-researcher expertise into the interpretive process.

By embedding member checking throughout the project, the AM-ME Research Group created findings that were rigorous and trustworthy to those most affected by them. This iterative dialogue between academic researchers, students, and teachers strengthened the legitimacy of the project and modeled an approach to validity rooted in shared authority rather than external verification alone.

### **Informing recommendations for shifts to education practice**

Through this project and the resulting findings, student and teacher co-researchers deepened their understandings of engagement and translated those insights into practical strategies for classrooms and schools. Their contributions clustered into three areas: reimagining instructional

practices, elevating relational and cultural supports, and envisioning systemic changes to better meet the needs of Black and Latino students.

### **Reimagining instructional practices**

Based on the project findings, students and teachers generated concrete ideas for making classroom instruction more engaging and inclusive. During action-planning activities, students recommended incorporating more projects and hands-on learning, emphasizing that "avoiding doing the same thing every day" would make math more relevant and exciting. They also suggested creating classroom environments with flexible seating, such as "student-made seating assignments," to foster comfort and collaboration. These ideas showed that student and teacher co-researchers began to see engagement as tied to variety, flexibility, and student choice rather than just task completion.

Teachers carried these insights into reflections on their own practice. One described wanting to "give extra opportunities for learning and understand their students' needs," emphasizing that engagement requires flexibility and responsiveness. Another noted that the project helped them think more critically about what professional development should look like, arguing that teachers need "specific things we can do in the classroom" rather than abstract advice. Together, these reflections show that student and teacher co-researchers pushed instructional practices toward being more dynamic, student-centered, and practically actionable as a result of participating in the AM-ME Research Group.

### **Elevating relational and cultural supports**

Students and teachers also identified the importance of supports beyond instructional strategies. Several students stressed the need for math help to be accessible during the school day, rather than only after school when many could not attend. As one student and teacher small group summarized, "Supports [should happen] during the day instead of after school [but] funding [is needed] for intervention." Other students highlighted the role of families, recommending that parents receive more information about engagement in math and be encouraged to have conversations with their children about it.

Teachers echoed these insights by reflecting on the barriers some students face at home, such as limited language support or competing responsibilities, and how those barriers shape math engagement. One teacher shared that they hoped to "spend more time talking to the quieter kid," showing an increased awareness of the need for relational attention to students who might otherwise be overlooked. These contributions underscore a broader view of engagement as intertwined with relationships, family support, and cultural context, and that they envisioned classroom practices that reflect those realities.

## Envisioning institutional changes

Finally, student and teacher co-researchers extended their recommendations beyond individual classrooms to broader school and district structures. Students suggested shifts to scheduling, such as creating common advisory times where teachers could provide targeted math help. They also proposed ensuring resources were available in multiple languages so families could access information and support. Teachers discussed using the data and insights from the AM-ME Research Group in their professional learning communities, describing the importance of carrying lessons from the project back to colleagues.

For some, these institutional recommendations reflected a new orientation to practice itself. A teacher noted, “[We] need [to administer] wave 3 of the survey to decide what instructional changes to make,” showing how the project fostered a mindset of continuous improvement rather than one-time reform. Students likewise recognized that their contributions could inform their own classrooms as well as future experiences for peers. As one wrote, they stayed engaged in the project because “this will help the kids we need to help.” These insights suggested a shift in how student and teacher co-researchers thought about change, from one-time fixes toward an ongoing effort to support math engagement across classrooms and cohorts.

By translating insights from the cPAR process into instructional, relational, and institutional recommendations, student and teacher co-researchers demonstrated how participatory research can directly inform practice. Their reflections and proposals underscore the potential for cPAR to generate new knowledge and to produce actionable strategies that schools can adopt to support Black and Latino students' success in math. Together, these contributions showed how students and teachers expanded their own understanding of math engagement, connecting it to instruction, relationships, culture, and institutional change.

## DISCUSSION

### Methodological contributions of cPAR

This study demonstrates how cPAR can serve as an innovative, yet underutilized, methodology for measurement development research. Our project illustrates how cPAR expands both the process and outcomes of measurement development by positioning Black and Latino students and their teachers as co-researchers in the creation of a culturally responsive measure of math engagement. In doing so, it responds to persistent critiques that research on youth too often renders marginalized populations invisible or depicts them primarily through deficit lenses (Causadias et al., 2023; Kumar & DeCuir-Gunby, 2023; Ladson-Billings, 2006; Syed et al., 2018). At the same time, it demonstrates how research methodologies can be adapted to reflect the cultural,

relational, and lived realities of diverse youth, rather than imposing narrow, one-size-fits-all approaches.

A central contribution of this study is its demonstration that methodologies matter for racial equity. Measurement development is typically a technical endeavor carried out by academic researchers with little input from those most affected by the resulting tools. The absence of diverse voices at the front end of instrument design often produces measures that fail to capture the cultural and relational dimensions of engagement, particularly for youth of color (López, 2022; Marks & Garcia Coll, 2018; McMahon & Portelli, 2004). By embedding cPAR into the measurement process, this project reoriented what was measured and how. Students and teachers redefined engagement to include relational trust, belonging, family supports, and systemic barriers, elements that are typically absent from compliance-oriented definitions. In this way, cPAR was not an add-on to traditional research but a methodological choice that expanded the conceptual boundaries of engagement itself.

The process also highlighted how methodological innovation can directly shape research quality. Students and teachers provided perspectives on constructs and altered the ways research was conducted. Their suggestions to adapt analytic tasks, revise survey items, and restructure meeting formats made participation more accessible and rigorous. Teachers' attention to classroom realities ensured that survey items were interpretable and useful for practitioners, while students' scrutiny of language revealed potential misalignments with their lived experiences. These contributions exemplify how rigor in cPAR is achieved through the deep participation of student, teacher, and academic researchers, as credibility was strengthened by iterative cycles of member checking and collaborative interpretation (Kemmis, 2006; Kemmis et al., 2013). Rather than relying solely on a researcher-driven definition of what qualifies as valid and trustworthy results, this study operationalized validity trustworthiness as a shared process in which those represented by the data held authority over its interpretation.

Equally important, methodological contributions were sustained by the relational environment cultivated in the AM-ME Research Group. Students explained that they remained engaged because their voices were taken seriously and their ideas carried weight in shaping decisions. Teachers described the group as distinct from typical professional development, emphasizing that it left them feeling affirmed and energized rather than diminished. These dynamics align with research on developmental relationships and relational trust, which highlight the importance of respect, care, and reciprocity for both learning and collaboration (Bryk & Schneider, 2002; Noddings, 2015; Rodríguez & Brown, 2009). In this way, the group's culture was integral to the methodology itself: without intentional practices that normalized respect and reciprocity, sustained participation, and high-quality data would have been unlikely.

## Implications for youth development and educational practice

The methodological insights described above directly shaped developmental outcomes for youth and informed recommendations for practical changes in schools, which has implications for youth development and education research at large, beyond the measurement development focus of this study. Consistent with prior research on participatory approaches (Anyon et al., 2018; Leman et al., 2025; Wagaman et al., 2023), youth in this study reported gains in agency, communication, empathy, and problem-solving skills. These developmental outcomes were integral to the production of better research, showing how methods that invite youth into the core of the process not only strengthen evidence but also broaden how developmental science understands adolescence by centering perspectives too often left out of knowledge production. As students gained skills and confidence, they contributed more substantively to item development and interpretation, resulting in a measure that was more culturally relevant and more credible to those it was designed to serve. In this sense, cPAR does not separate methodological rigor from youth development, but treats the two as mutually reinforcing.

The study also contributes to diversifying who is represented in the literature. Black and Latino youth remain underrepresented in developmental science and are disproportionately described through narratives of underachievement and disengagement (Kumar & DeCuir-Gunby, 2023; Syed et al., 2018). By centering their lived experiences in the co-construction of a measure, this study helps correct those portrayals. The youth in this project were framed as experts in their own schooling who provided critical perspectives on how engagement unfolds, generating recommendations about teaching practices and educational systems. Their participation demonstrates how methodologies that center marginalized youth can shift the focus of research from deficits to assets, from individual shortcomings to systemic responsibilities.

Finally, the project demonstrates that participatory methodologies can produce findings that are immediately relevant for practice. Students and teachers moved beyond conceptual discussions of engagement to identify strategies that schools could act on. Their recommendations included incorporating project-based learning, offering varied instructional approaches, restructuring schedules to allow advisory periods for targeted math support, and increasing attention to family engagement and language accessibility. These kinds of actionable insights echo prior participatory studies where youth involvement led to practical innovations in schools and communities (Anyon et al., 2018; Sandwick et al., 2018; Smith et al., 2024). They also respond to longstanding critiques that conventional research often studies marginalized youth intensively without producing benefits for them (Fine & Torre, 2021; Ladson-Billings, 2006). By ensuring that Black and Latino students could see their perspectives translated into strategies that teachers and districts could adopt, this

project demonstrated how participatory methodologies can bridge the persistent gap between research and practice. In this way, research becomes a vehicle for institutional responsiveness and accountability, rather than an extractive process that leaves youth voices unheard.

## Limitations

Several features of this study limit its transferability. The work was situated in a single district with five secondary schools, and all teacher co-researchers were White, which does not reflect the full racial and linguistic diversity found in many districts. Student participation also shifted over time as young people transferred schools, a dynamic that is common in multi-year projects, but one that complicates continuity of involvement. The data sources, such as reflection activities, check-ins, and action-planning artifacts, were well suited for tracing process but do not support causal inference. While essential to any research that meaningfully involves community members, we recognize that the supports built into this project, including stipends and intentional relational practices, likely enhanced engagement but may not be feasible in every project or context. Relatedly, as much as we intentionally provide support to sustain participation (e.g., providing stipend and transportation), our process of recruiting student and teacher co-researchers might have favored those who face less barriers to engaging in an intensive, participatory project like this. Finally, despite deliberate efforts to share authority, the division of labor between academic researchers, who led coding, and students and teachers, who engaged in member checking and interpretation, reflects lingering hierarchies that participatory traditions aim to challenge.

At the same time, it is important to note that this lack of transferability is not simply a limitation, but also an intentional feature of the design. By centering the lived experiences of Black and Latino students, the study resists broad generalizability in favor of amplifying voices that are underrepresented in measure development (Kemmis, 2006).

## Implications and directions for future work

The study suggests several paths for researchers who seek to bring innovative, youth-centered methodologies into measurement development. First, design participation at the front end of construct formation. When students and teachers shape the definition of a target construct, the resulting content domain reflects cultural and relational dimensions that standard measures can miss. Second, plan for credibility as a shared practice. Member checking can be built into coding meetings, item review cycles, and interpretation sessions so that validity rests on an evidentiary chain that participants recognize. Third, study use as well as creation. Following schools as they administer a cPAR-developed measure can clarify how teachers interpret results,

which actions they take, and whether student engagement changes over time.

Implications also extend to practice and systems. Districts can create routines that mirror the design choices that supported this work: stipends, course credit, or professional development credit for participation, meeting structures that fit the school day, and analytic tools that students can use to examine their own data with adults. Schools can integrate results into professional learning communities and improvement cycles, using the measure to track engagement patterns and to test concrete changes, such as advisory time for targeted support, family-facing communication in multiple languages, and instructional activities that promote collaboration and belonging. Teacher education and leadership programs can include training on participatory measurement development so new educators learn to co-construct evidence with students rather than implement tools made elsewhere.

Finally, the project points toward policy considerations. Institutional review procedures can be structured to recognize youth as collaborators, including compensation for work, authorship where appropriate, and mechanisms for shared decision making. Funding models can budget for translation, transportation, food, and technology that make sustained participation possible for students who navigate school, work, and family responsibilities. Data governance can include student and family voices in decisions about how measures are used, what feedback is returned to classrooms, and how results inform improvement rather than surveillance.

Taken together, these implications argue for a broader shift in how developmental and educational sciences approach measurement with diverse youth. Methodologies are not neutral. They can reproduce invisibility and deficit framings, or they can invite students and teachers to define problems, generate evidence, and act on what they learn. This study shows that a cPAR methodology makes measurement development more culturally responsive and credible, while producing insights that educators can use. As the field continues to diversify its samples and methods, future research can test this approach in new contexts and with additional populations, examine its psychometric performance at scale, and document how participatory measures support sustained improvements in teaching and learning.

## CONCLUSION

This study examined a cPAR approach to education measurement development with Black and Latino students and their teachers. The design placed students and teachers as co-researchers in a multi-year process to define math engagement, co-create items, interpret qualitative evidence, and carry findings back into schools. The work demonstrates an innovative methodology that is still uncommon in research and by showing how such a methodology can sharpen understanding of diverse youths' experiences. The

central contribution is methodological: When construct development, coding, and interpretation are shared across students, teachers, and academic researchers, the construct being researched is conceptualized in ways that reflect cultural and relational realities, the research process becomes more credible to those represented by the data, and practice recommendations emerge that schools can use.

The project also illustrates how methodological design can shape developmental processes for students and teachers. Students described gaining confidence as analysts and communicators, increasingly viewing themselves as contributors to knowledge rather than as subjects of research. Teachers experienced parallel shifts, coming to see themselves as researchers who could analyze data with students and share findings with colleagues. These developmental changes directly enhanced the quality of the research. As students and teachers built new skills, they refined constructs and clarified item wording, which in turn reinforced their growth as co-researchers. The outcome was a measure that student, teacher, and academic co-researchers recognized as credible and actionable, accompanied by practice recommendations that linked classroom instruction to relationships, family supports, and school routines. In doing so, the project addressed two persistent gaps in the literature: the invisibility of marginalized youth in measurement development and the disconnect that often separates research from the realities of schooling.

## AUTHOR CONTRIBUTIONS

**Ta-Yang Hsieh:** Conceptualization; funding acquisition; methodology; investigation; writing – review and editing; writing – original draft; formal analysis; data curation; validation. **Samantha E. Holquist:** Conceptualization; formal analysis; writing – original draft; methodology; investigation; supervision; project administration; writing – review and editing; validation; funding acquisition; resources. **Claire Kelley:** Methodology; investigation; writing – review and editing. **Alyssa Scott:** Data curation; formal analysis; writing – review and editing; validation; investigation; methodology. **Olivia Reyes:** Methodology; investigation; writing – review and editing. **Marisa Crowder:** Funding acquisition; methodology; investigation; writing – review and editing. **Mark Vincent B. Yu:** Writing – review and editing; investigation; methodology; funding acquisition.

## ACKNOWLEDGMENTS

The Adapted Measure of Math Engagement (AM-ME) Research Group included six students (Antonio Chavira, Brianna Espy, Ryan Ombongi, Serrah Ssemukutu, Salma Ahmed, and Diamond Tony-Uduhirinwa), five teachers (Nathan W. Earley, Karina Mazurek, Kathleen Morgan, Karla Rokke, and Ashly Tritch), and seven researchers (Marisa Crowder, Samantha E. Holquist, Diane (Ta-Yang) Hsieh, Claire Kelley, Mark Vincent B. Yu, Alyssa Scott, and Olivia Reyes). The research group jointly designed and implemented the study and collaborated in disseminating the findings. Bloomington Public School District leaders

Betsy Hawes, Marcie Coval, Julio Caesar, and Rik Lamm provided support to this work. Jennifer Widstrand served as the project manager.

## FUNDING INFORMATION

This project is funded by the National Science Foundation, grant #2200437, and Overdeck Family Foundation. Any opinions, findings, and conclusions or recommendations expressed in these materials are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or Overdeck Family Foundation.

## CONFLICT OF INTEREST STATEMENT

The authors declare that they have no actual or perceived conflict of interest in the conduct and reporting of research.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## ETHICAL APPROVAL STATEMENT

All study procedures, including the student and teacher co-researcher involvement, were approved by an Institutional Review Board (IRB#: FWA0005835) on October 5, 2022. Parental or guardian consent was secured for all students participating in the AM-ME Research Group.

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**How to cite this article:** Holquist, S. E., Hsieh, T.-Y., Scott, A., Yu, M. V. B., Crowder, M., Kelley, C., Reyes, O., & (2026). Taking a critical participatory action approach to education measurement development. *Journal of Research on Adolescence*, 36, e70195. <https://doi.org/10.1111/jora.70195>