

Decolonizing Mathematics Education Through Storytelling: A Tool for Exploring Identity, Justice, and Community

Abstract

This structured poster session reimagines mathematics education through the lens of storytelling, emphasizing how telling stories together connects mathematics education to identity, justice, and community. Building on theoretical frameworks such as Funds of Knowledge, Counter Storytelling, Narrative Inquiry, and Narrative Identity, this session engages in posters that explore how storytelling revolutionizes mathematical understanding and teaching. Participants will engage in examples of storytelling in mathematics education practices and then participate in a dynamic Storycircle to experience the creation and sharing of their own math stories. Join us in pushing the boundaries of mathematics education research to learn how narratives decolonize mathematics and foster more humanizing approaches to math education.

Session Summary

1. Objective of the Session

This poster session challenges traditional mathematics education research by highlighting the power of storytelling and narrative to engage in research that connects to identity, justice, and community. Each poster showcases how narratives can be used as tools for decolonizing mathematics education practices in order to foster a deeper, more humanized framing of what is and isn't mathematics.

2. Overview of the Presentation:

The structured poster session revolves around two events: 1) Discussions of the various cases of storytelling in mathematics education presented in the structured posters and 2) An opportunity to participate in an interactive Storycircle (Lambert, 2020). The posters present diverse case studies and projects where storytelling has been employed to integrate identity, critical theory, and social justice into mathematics education. The Storycircle will allow attendees to experience firsthand the creation and sharing of their own mathematical narratives, providing a space for reflection and feedback.

3. Scholarly or Scientific Significance:

This session contributes to the scholarly discourse by presenting storytelling as a transformative tool in mathematics education. By incorporating theoretical frameworks such as *Funds of Knowledge* (Moll et al., 1992; Turner & Drake, 2016), *Counter Storytelling* (Solórzano & Yosso, 2002), *Narrative Inquiry* (Clandinin & Connelly, 2000), *Narrative Identity* (Sfard & Prusak, 2005), *Storythinking* (Fletcher, 2023), and *Mathematics Storytelling* (Singh, 2017), the posters highlight the potential of narratives to challenge and decolonize traditional mathematical paradigms in research. Through a storytelling approach, mathematics education research focuses less on measurement, sorting, and comparing, and more on listening, connecting, and growing.

4. Structure of the Session:

1. Introduction (5 minutes)

- Welcome, acknowledgements, and grounding of the posters presenters in this session.
- Overview of the various ways a storytelling approach challenges traditional mathematics education research.
- Preview of the posters in the session.

2. Poster Gallery Walk (35 minutes)

- Attendees will walk around to explore the various posters that present diverse uses of storytelling in mathematics education research.
- Presenters will engage the small, roving groups in discussing their projects, methodologies, and findings, and lessons learned through anecdotes and storytelling.

3. Storycircle Activity (35 minutes)

- Attendees come together and are introduced to the concept and theory behind a Storycircle.
- In small groups of 3-5, each attendee will be given a few minutes to recall and share a mathematics story from their own world. These are stories in progress, allowing the storyteller the opportunity to feel out the story, to connect their own humanity and identity with the story.
- Each attendee will also give and receive feedback, critical comments, and questions about their story
- Attendees will end the Storycircle reflecting on this experience and its implications for mathematics education research.

4. Large Group Discussion (15 minutes)

- The chair will share their observed thoughts and reflections from the various posters and the Storycircle experience.
- The chair will orchestrate a large group discussion that connects the examples from this session to the larger sociopolitical role of mathematics education to foster decolonization, not just in education, but for everyone.

- The chair will end the session with a summary of ways that storytelling techniques promote a more humanizing and critical approach to mathematics education research.

5. Conclusion:

This structured poster session aims to revolutionize mathematics education research by showcasing emerging research that builds from the transformative power of storytelling. By connecting mathematical teaching and learning to narratives that involve identity, justice, and community, attendees will learn how they can foster critical, humanizing, and accessible mathematics education research. We invite participants to explore these innovative practices and consider how they might incorporate storytelling into their own research to challenge traditional paradigms and promote decolonization and justice in mathematics education.

1. Digital Mathematics Storytelling with Recently Migrated Youth

Digital Mathematics Storytelling (DMST) is an innovative educational approach that leverages the power of storytelling to connect mathematics with community, cultural, and family identities. Through this method, educators help youth and teachers develop critical digital media literacy, addressing the educational and societal impacts of digital media as well as fostering mathematical exploration. This poster presents the ways that a DMST workshop for youth who have recently migrated to the U.S. (voluntarily and involuntarily) opened up space for the exploration of mathematics, digital, and cultural identities and literacies as connected to the ongoing aftereffects of colonization.

Storytelling is fundamental to human culture, a medium for passing down knowledge, traditions, and values across generations. The original culturally sustaining pedagogy, storytelling opens up space for youth voice and agency, particularly for those within marginalized communities. In education, storytelling decolonizes practices by centering community and family knowledge rather than continually relying on external, Eurocentric epistemologies. And in mathematics, storytelling enables learners to relate mathematical concepts to their lived experiences, making learning more meaningful and relatable.

However, the popularity of modern digital and social media has disrupted traditional storytelling. While many of the voices on YouTube and TikTok center diverse influencers and storytellers, these mediums still impose Western narrative structures and capitalistic motives that overshadow diverse cultural narratives. The dominance of these narratives alienate youth from their cultural storytelling roots and promote passive consumption over active engagement.

Identities, crucial to the way youth see themselves in the world, are dynamically constructed through storytelling (Sfard & Prusak, 2005). Furthermore, counter-storytelling, which challenges dominant narratives and stereotypes, involves those from marginalized communities reclaiming their own narratives and identities (Solórzano & Yosso, 2002). In particular, using narrative structures from pop-culture, such as superhero narratives, can help youth foster their own counter-storytelling without having to vulnerably center their stories on themselves (Enciso, Krone, & Solange, 2023).

In the Spring of 2024, we enacted a 4-day Digital Mathematics Storytelling workshop to serve 12 migrant youth, aged 8-14 in the Midwestern region of the United States. The youth spent the time creating video or comic superhero mathematics stories, sharing and refining these stories in

storycircles, finalizing these stories, and then presenting them at a community screening celebration.

The stories presented centered on the multiple experiences of the youth through their immigrant narratives. For instance, an elementary-aged youth from Southeast Asia made a video in which a superhero fought against bullies who teased and ostracized a child who recently moved to the U.S. In another case, a middle-school-aged youth from Africa crafted a superhero story where supervillians who got superpowers and their direction from a violent, dictator-run military took over the country. Finally, a middle-school-aged youth recently from Central America crafted a story about a superhero who struggles because nobody talks to or can understand this hero.

To culminate the week, each youth presented their story in an emotional community screening, to not just celebrate their hard work, but to recognize their unique mathematical and storytelling agency.

2. In Circles Within Affinity Spaces: Black Women Pre-Service Teachers' Narratives of Their Mathematics Teacher Identity

For pre-service teachers (PSTs) to excel in enhancing students' learning in mathematics, it is essential for them to examine their own mathematics teacher identities. While existing literature has explored teacher identity development in pre-service teachers, research in elementary mathematics education concerning Black PSTs is scarce, particularly Black women. This poster examined the construction of mathematics teacher identity among Black women PSTs in a hybrid elementary mathematics methods course at a predominantly white institution. The research explored the use of comics storytelling to visually articulate their experiences as mathematics teachers. Grounded in Black feminist thought (Collins, 2000), mathematics teacher identity (Aguirre et al., 2013; Chao, 2012), and storytelling theories (Lambert, 2013; Sfard & Prusak, 2005), this study employed narrative inquiry (Clandinin & Connelly, 2000; Kim, 2016) with an ethnographic perspective (Green & Bloome, 2004). Analysis of data sources in this study involved a thematic analysis (Braun & Clarke, 2006) and narrative analysis (Cortazzi, 1993).

In addition to developing a protocol for using comics storytelling as a visual narrative tool, the study found that story circles in affinity spaces within a mathematics methods course were powerful in breaking "Black silence" and disrupting the assumption that all PSTs were aware of their mathematics teacher identity. Sharing their comics with the larger class allowed white colleagues to engage and interact with the experiences of these Black PSTs, taking a step toward dismantling the invisible white wall that separates and silences marginalized PSTs.

Furthermore, central to their mathematics teacher identity formation was the "cultivation of images" – of the child and the teacher. Findings also showed a profound connection between the Black pre-service teachers' narratives, their personality, and their mathematics teacher identity. Through story circles, reflections, and discussions, the Black women PSTs recognized their evolving mathematics teacher identities, understanding that positive evolution requires community, sharing, and reflection. The affinity space evolved into a support group, wherein the PSTs also recognized the first author as a role model.

In connection to AERA 2025, this research significantly contributes to the theme, "Research, Remedy, and Repair: Toward Just Education Renewal," by addressing the underexplored area of Black women PSTs' mathematics teacher identity. Through creative mediums such as comics storytelling and affinity spaces, the study provides insights (Research) into how these educators construct and evolve their mathematics teacher identities amidst systemic barriers. It proposes actionable strategies (Remedy) by showcasing how supportive and reflective communities can break "Black silence" and challenge misconceptions in predominantly white institutions.

Additionally, the research emphasizes the importance of continuous reflection and community engagement for the positive evolution of mathematics teacher identities, thereby promoting resilience and agency among marginalized educators (Repair). This approach aligns with the goal of just education renewal by advocating for intentional reflective practices in mathematics methods courses and amplifying voices of PSTs from marginalized communities; thus, fostering inclusive, equitable educational environments.

3. Challenging Stereotypes: Rural Indonesian Youth's Mathematical Identities through Digital Narratives

I aim to explore the mathematical identities of rural youth through digital mathematics storytelling workshops in Indonesia. Specifically, my objective is to understand how rural youth construct their mathematical identities and challenge stereotypes using digital storytelling.

This research is grounded in three theoretical frameworks: counter storytelling, funds of knowledge, and mathematics identity. I chose counter storytelling because it empowers marginalized communities to voice their experiences, challenge dominant narratives, and foster empathy and understanding of often untold narratives (Delgado, 1998; Solórzano & Yosso, 2002). I selected the funds of knowledge for its emphasis on integrating community-based learning into classroom teaching to create a more inclusive learning environment and enhance student engagement (Moll et al., 1992). Mathematics identity helps us focus on how they see themselves as mathematics learners, influenced by their interactions in educational settings and broader societal contexts (Aguirre et al., 2013; Nasir & De Royston, 2013).

I employed a qualitative approach using narrative inquiry research design to explore the participants' stories. I chose narrative inquiry for its appreciation of the complexity of lived experiences and its ability to provide insights into how educational policy and practice can be more responsive to students' needs and aspirations (Bell, 2002; Connelly & Clandinin, 1990). Data collection occurred through a story circle activity where participants shared and received feedback on their narratives (Lambert, 2018).

I recruited eight participants, aged 16 to 17 years, from a rural high school in Indonesia. Data were collected through digital videos, field notes, questionnaires, and audio reflections, providing a comprehensive view of their mathematics learning journey. Digital videos captured students' interactions with mathematics in everyday life, while peer feedback enhanced their learning experiences and storytelling video.

The results indicated that rural students co-construct their mathematical identities and challenge stereotypes about their academic abilities through digital storytelling. The narratives highlighted the transformative role of family support and educational encouragement in cultivating a positive mathematical identity. For example, Hera, initially disinterested in mathematics, developed an interest and competence through family encouragement and involvement in mathematics courses. Similarly, Nadia's perception of mathematics changed positively after receiving support from family and motivating teachers. These narratives collectively challenge the stereotype that rural students are less capable of achieving high academic scores in mathematics and

demonstrate that, with the right support, they can excel and redefine their academic potential beyond societal expectations.

This study contributes to the literature on digital storytelling in mathematics education, particularly in rural settings, through providing empirical evidence on how rural youth co-construct their mathematical identities and challenge stereotypes. These findings underscore the importance of leveraging family and educational supports to transform rural students' engagement with mathematics. Additionally, this research highlights the potential of digital storytelling as a pedagogical tool to connect mathematics to students' everyday lives and experiences, fostering a more inclusive and equitable educational environment.

4. Lift Every Voice: Storytelling from Rural Texas Teachers

Stories from a two-year professional development (PD) project capture the character of learning and teaching from rural teachers' perspectives and add depth and context to project outcomes. Teachers' stories reveal to researchers "what sticks" and why, unexpected outcomes, and better understanding of intended outcomes.

Teacher narratives support understanding of rural teachers' lives (e.g., Burton et al., 2013) and how rural teachers navigate the advantages, disadvantages, and community relationships in their classrooms (Gallo, 2020; Preston, 2012). Stories can provide a counternarrative to the view that rural teachers are resistant to change or are deficient in some way (Burton et al., 2013).

Our PD was designed to empower teaching mathematics in ways that made sense to teachers. I acknowledged that rural teachers often work in isolation and have few opportunities to work with other teachers because they are one of a few or the only math teacher at the middle grades or do not have professional development opportunities in their small, remote districts. I also recognized that middle grade mathematics lessons were often procedural without connections, and that many middle grade students were not successful in mathematics.

The two-year project included two intensive summer workshops, 2-day follow-ups in spring and fall for each year, and reflections and assignments submitted online during both years. Quantitative results were promising, but they lacked the context of teacher's perspective. Stories collected during and after the project added to our understanding of the impacts our PD made on teachers in their rural contexts. Teacher stories were documented in two ways. During meetings we routinely asked teachers to report out how they were implementing what they learned in lessons by asking "Who has a story?" And, at the end of our work with them, three of the teachers drafted essays reflecting on using what they learned in their classrooms.

Stories featured in this study include video-taped testimonials from project meetings and teacher authored essays which provided detailed accounts of teacher-identified experiences.

We learned that teachers were reflective about how the problems worked for students, and that changes were made based on student engagement and understanding. As they challenged students and themselves, they learned about student thinking, often revealing strengths not observed before. Notably, teachers' stories were often about students identified as low achievers who succeeded once teachers offered opportunities to solve problems and responded to student thinking. Rurality played a role in how teachers framed their math tasks, and the relationships teachers had with the community, other teachers, and their students.

Narratives provided depth to our quantitative results showing growth in teacher knowledge, beliefs, and instructional practices (Author). Stories serve more than researchers interested in the

results of their work by putting learning into context to remind us of the daily lives of teachers. I believe stories need to be shared in full, so that teachers can learn and share from each other. Stories are necessary to understand how teachers navigate the challenges of student-centered problem-solving teaching in rural settings.

5. What People Eat: Youth Telling Data Stories through Critical Data Visualization Reading

Current data science education research increasingly focuses on making learning experiences accessible and inclusive, particularly in K-12 settings. Traditional data science education, rooted in computer science and mathematics, can often exclude diverse participants, leading to a lack of representation (Jiang et al., 2022). To address this, one promising approach is to engage youth in critically reading and reimagining existing data visualizations. This method encourages students to analyze the formatting (what variables are represented), framing (how variables are related), and narrating (what stories can be told) of a visualization, then reformat, reframe, and re-narrate it (Rubel et al., 2021). Of these, renarrating is particularly vital as it allows students to engage with data in a low-stakes manner (Zhao & Dyer, 2024). However, the process by which students construct their data stories is still underexplored.

In this poster, we present our preliminary findings on youth data storytelling when critically reading a data visualization. We applied two of Radinsky's (2020) data narratives modes: encompassing data into existing narratives and narrating oneself into a data-represented world. Our research involves an analysis of six semi-structured interviews with middle school students (pseudonyms: Ronald, Roy, Ben, Clark, Ruth, and Faith) who participated in a 14-week data-art inquiry project at an afterschool youth community club in East Tennessee in Fall of 2023. During the interviews, students were given 15 minutes to explore a data visualization about calorie intake and diet structure (<https://www.nationalgeographic.com/what-the-world-eats/>), followed by eight data reimagining questions derived from Rubel et al.'s (2021) framework. We recorded and transcribed the interviews, then conducted a thematic analysis (Braun & Clarke, 2012) to identify patterns in their data storytelling.

Our analysis found two themes of participants narrating as part of the existing story and others narrating themselves into their own stories. Illustrating the first theme, Roy, Clark, and Faith constructed stories by presenting their data understanding into the given data visualization's existing narrative. Roy observed that global diet structures vary significantly, with different percentages of calories coming from various food categories. Clark highlighted the stark contrast in calorie intake between countries, noting that Americans consume an average of 3,600 calories daily, primarily from sugar and fat, compared to the healthier 1,600-calorie diet in Somalia. Faith compared the calorie intake of the United States and India, concluding that the Indian diet is healthier due to lower calorie intake and a higher proportion of grains.

In contrast, in illustrating the second theme, Ronald, Ben, and Ruth narrated themselves into their data stories. Ronald linked the unhealthy diet structure in the U.S. to his experiences with fast-food prevalence. Ben discussed the decline in produce consumption since the 1990s, advocating for increased vegetable and fruit production for healthier diets. Similarly, Ruth called for more awareness of dietary habits by comparing American calorie intake with global patterns.

These findings suggest that data storytelling fosters a deeper understanding of the information presented in data visualizations. By allowing students to either build/extend narratives based on data or position themselves within these narratives, this approach offers a more inclusive and meaningful entry point into data science education compared to traditional methods focused solely on symbolic representation. It also opens up the potential of other ways students can narrate and develop connections in the context of data visualizations. We propose to integrate data storytelling into data science education programs to promote inclusivity and accessibility.

6. Engaging Indonesian Teachers through Digital Mathematics Storytelling: Enhancing Identity and Community Connection

This poster explores the use of Digital Mathematics Storytelling (DMST) among Indonesian mathematics teachers to enhance their mathematical identities and integrate community-based mathematical knowledge. Traditional mathematics teaching in Indonesia often marginalizes local knowledge in favor of a Eurocentric perspective. DMST challenges this norm by incorporating community-rooted mathematical narratives into educational settings, thereby enriching teacher identity and fostering a comprehensive understanding and appreciation of mathematics.

Globally, mathematics education tends to emphasize traditional, academically-focused mathematics learning practices, often overlooking the rich mathematical knowledge-sharing practices of non-white communities. This project examined the impact of DMST, a technology-enhanced teaching tool inspired by the ancient practice of storytelling, on mathematics teachers in Indonesia. Through a three-day DMST workshop, pre-service and in-service teachers created short videos (1-5 minutes) that explored their mathematical identities in relation to their family, community, and culture.

In Southeast Asia, academic success in mathematics is often linked to family wealth and access to tutoring rather than the ability to bridge in-school and out-of-school mathematical knowledge. This gap leads students to distance themselves from mathematics and avoid STEM careers. By adopting a funds of knowledge approach and storytelling practices, DMST fosters connections to community histories and inter-generational knowledge sharing. This approach enables teachers from and serving marginalized communities to engage in counter storytelling, confronting negative stereotypes and reshaping their identities around mathematics.

Utilizing a *Community Participatory Design* methodology, the research team conducted a DMST workshop consisting of three four-hour sessions over a week. Each session included Storycircles, where participants shared and refined their stories through small-group feedback. The final session involved a community screening of the video stories, followed by group discussions on the themes and connections to teacher identity. Participants were active collaborators, providing continuous feedback that shaped the workshop's structure and focus.

The study involved sixteen mathematics teachers enrolled in graduate programs at a large, public teacher education-focused university in Indonesia. Participants ranged from pre-service teachers to those with over 15 years of experience. Data sources included the final digital stories, pre- and post-workshop questionnaires on mathematical identity, digital literacy, and community mathematics dispositions, field notes, and recorded discussions. Data analysis involved

transcribing and translating video and audio data, with a focus on the impact of DMST on teacher identity, dispositions, and digital literacy.

Findings indicated that teachers engaged deeply with the concept of counter storytelling. Fourteen out of the sixteen stories included counter narratives related to gender, socioeconomic status, ethnicity, age, and parental status. This experience opened space for teachers to explore their positional identities in mathematics and how these identities influenced their teaching practices. For instance, several stories involved how teachers connected their Muslim faith to their teaching identity, addressing how Muslims are negatively positioned in mainstream society.

Teachers also used the stories to confront damaging stereotypes connected to their identities, such as the expectation for female-identifying teachers to balance family responsibilities with their careers, unlike their male-identifying counterparts. The post-workshop surveys revealed that this DMST process helped teachers connect their mathematics teaching to humanizing practices, allowing them to teach from the heart rather than adhering to a purely technical approach.

The DMST experience demonstrated the global potential of DMST to impact mathematics teaching in environments with a deep history of colonizing pedagogical influences like Indonesia. Through storytelling, teachers were able to bridge personal and professional identities and confront debilitating societal structures within mathematics education, such as neo-colonialism and sexism.

7. Storythinking with Other People's Perspectives

Storytelling pedagogy values students' local knowledge, ingenuity, and commitments to justice (Krone 2019; Torres 2022) as they draw on their everyday interests, identities, and experiences. We present two case studies of ten-year-old children (white male, Black immigrant female) who participated in a seven-day 'storythinking' curriculum that introduced and supported children's applications of three key narrative features: 1) world-building, 2) perspective-taking and shifting, and 3) problem-solving or action-generating, all of which involve asking 'why' a problem matters and 'what if' a solution might be more or less useful to someone who is seeking a solution (Fletcher & Benveniste 2022). By organizing perspectives and events into 'what if' scenarios, we can search the problem-world for clues and anticipate consequences, with a concern for our shared humanity. We argue that when mathematical problem-solving is grounded in narrative practices (Fletcher 2021, 2023), and culturally relevant tenets (Ladson-Billings 2014; Warren 2014; Milner 2020) of rigorous and joyful learning, cultural consciousness, and equity, children learn to build on one another's mathematical ideas, especially those whose perspectives were previously marginalized.

Our qualitative data set (audio recordings, photographs, field notes, and curricular plans) illustrates two students' pathways through 'storythinking' experiences and the narrative and mathematical features of their multimodal plans for a 'cinematic bicycle drone' and a 'swimming pool art gallery.' Twenty-eight third, fourth, and fifth graders participated in a two-week summer camp in June 2022. Students joined the camp at no cost and were drawn from the district's economically and racially diverse schools. Teachers (white and Black) were responsible for implementing the curriculum while researchers (identified as white, Asian, and Latine) documented children's interactions during whole and small group activities.

Descriptive case studies (Dyson & Genishi 2005) were constructed for two fifth-grade students, Ilana (East African) and Mark (white), who were initially reserved (Ilana) or outspoken (Mark) but became more actively engaged with others' ideas by the end of camp. One key practice informed all activities: generating the qualities and interests of a 'creative friend' whose perspective could be 'borrowed' to help solve problems. Ilana identified her mother, who was

generous, faithful, kind, but afraid of water (and Ilana wanted to go swimming). Mark identified his brother, who was adventurous, an avid bike rider, and loved to make movies.

On the last day of the sessions, children were asked to think of their creative friend's need or problem and to propose a plan—a blueprint—that would surprise them and maybe solve a deeper problem (their 'why'). Ilana first drew a swimming pool but needed something more to entice her mother to water. Listening to her peers and considering what her mother enjoyed (art), she envisioned a swimming pool that doubled as an art gallery so her mother would be more relaxed and willing to learn to swim. Her pool design benefited from peers' enthusiasm about angles and reflections and how the art might change underwater. Mark realized that a drone could follow his brother as he rode his bike—so he drew an elaborate plan for a drone that could move through multiple angles, heights, and speeds. He demonstrated the drone's capabilities with his body, using his own joints as proxies for the drone's movements.

These cases exemplify the educational equity and thriving that can be provided through a curriculum based on storytelling and culturally relevant tenets.

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