

WHY AM I SUPPOSED TO LOVE MATH?: DIGITAL MATHEMATICS STORYTELLING IN ASIAN AMERICAN COMMUNITIES

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In this research study, we detail how Digital Mathematics Storytelling, in which youth create video stories detailing the mathematics knowledge existing within their families and communities, can actively create counter-stories to the model minority myth. Through intergenerational video storytelling in historic Asian American communities, the research team and participants used a community participatory action research and narrative inquiry framework to engage elementary and middle-school aged youth in mathematics-based storytelling that not only detailed the painful effects of the model minority myth but also showcased that mathematics identities within Asian American communities can be rich and joyful.

Keywords: Equity, Inclusion, and Diversity; Informal Education; Social Justice; Technology

Objectives

Within the realm of mathematics education, Asian Americans youth must actively combat the destructive stereotype known as the “model minority myth,” which historically reinforces the idea that Asian Americans are somehow naturally gifted in mathematics (Chen & Buell, 2017; Lee, 1996; Shah, 2019). This stereotype not only erases the diversity of experiences within the Asian American community, but also positions Asian American youth as only being able to achieve success in mathematics-related enterprises. This harmful stereotype, coupled with the lack of Asian American stories in the mainstream media, paint Asian Americans as a singular monolith, ignoring the vast academic diversity within the Asian American community and leading to generalizations, hate, and even violence against Asian Americans (Gover et al., 2020; Takaki, 1998).

This research proposal explores how Digital Mathematics Storytelling can be used to elicit culturally sustaining mathematics stories within Asian American communities. Specifically, this research focuses on how intergenerational youth-led video stories created within a community participatory action research and narrative inquiry research project frame how Asian American youth position themselves around mathematics. Through these stories, Asian American youth actively craft counter-stories that not only create unique mathematics identities honoring their culture, but also push back against destructive stereotypes such as the model minority myth.

This research project is framed by two research objectives:

1. To examine the ways in which Digital Mathematics Storytelling can be used to elicit intergenerational stories about mathematics within Asian American communities.
2. To analyze counter storytelling by youth and their community and family members that actively combat stereotypes about Asian Americans and mathematics.

Theoretical Perspectives

The use of Digital Mathematics Storytelling as a means of exploring culturally significant mathematics stories in Asian American communities draws on multiple, intersecting theoretical frameworks, as detailed below.

Critical Race Theory

A Critical Race Theory perspective positions race as neither a fixed or real construct, but rather a socially constructed phenomenon produced and reinforced by existing systems of power and oppression (Delgado & Stefancic, 2012; Ladson-Billings & Tate, 2006). This perspective problematizes the traditional understandings of race and racism, recognizing that racism is not a series of isolated incidents but rather an enduring part of society and the legal system (Bell, 1995; Crenshaw, 1991). Through its emphasis on narrative and counter-storytelling, Critical Race Theory disrupts dominant narratives, thereby unveiling ways in which existing power and educational structures perpetuate racialized forms of inequality and injustice. By challenging the presumed neutrality and objectivity of legal structures and social institutions, Critical Race Theory reveals that our structures are often inherently imbued with racial biases. Consequently, Critical Race Theory functions not only as a theoretical lens but also as a methodological tool for interrogating the relationships between power, law, and race.

AsianCrit

AsianCrit is specific framework of Critical Race Theory that seeks to challenge dominant narratives about Asian Americans and promote a more nuanced understanding of the experiences and perspectives of Asian Americans (Museus & Iftikar, 2013). Drawing from the field of Asian American studies, the key tenets of AsianCrit include the intersection of race, class, gender, and sexuality, and the need for community-led activism and solidarity across diverse Asian American communities. The tenets of AsianCrit are powerful frameworks for recognizing and challenging harmful stereotypes about Asian Americans. Particularly in the realm of mathematics education, an AsianCrit framework helps to challenge the monolithic representations and recognizing the multifaceted realities of these students, an AsianCrit perspective in mathematics education can promote equitable educational outcomes, not only in terms of academic performance, but also in cultivating a truly inclusive, supportive, and representative educational environment.

The Model Minority Myth

The model minority myth is a stereotype that categorizes Asian Americans as uniformly successful, industrious, and academically outstanding, suggesting that they serve as a “model” minority group within the United States (Chang & Au, 2007; Chow, 2017). However, this simplistic narrative overlooks the rich diversity and multifaceted experiences within the Asian American community, unintentionally perpetuating harmful stereotypes that can lead to further marginalization and discrimination. Moreover, the myth disregards the past and present racial prejudice and violence endured by Asian Americans, including systemic exclusion and hate crimes (Hartlep, 2013).

The model minority myth also incorrectly suggests that other minority groups could achieve similar levels of success if they were to “work hard enough,” thereby negating the impacts of systemic and structural barriers that obstruct upward mobility. This presumption is detrimental not only to Asian Americans but also to other minority groups, as it fosters harmful stereotypes and veils the realities of racial inequality and discrimination in the United States. For instance, the stereotype of Asian Americans as passive and compliant workers is used to unfavorably compare and thus disadvantage other racial and ethnic minority groups in the USA, reinforcing a system of power that incites division among non-white communities (Ng et al., 2007).

In mathematics education, the AsianCrit framework helps to make visible this “model minority myth”. It highlights the absurdity of generalizing that all Asian Americans excel in mathematics and shows how this flawed assumption conceals the academic needs and struggles of various groups within the Asian American community.

Culturally Sustaining Pedagogy

Culturally Sustaining Pedagogy is an educational framework that seeks to promote equitable and inclusive education for students from diverse cultural backgrounds (Paris & Alim, 2014). Drawing on the fields of multicultural education and critical pedagogy, the construct of culturally sustaining pedagogy emphasizes validating and valuing students’ cultural identities and learning experiences. This approach recognizes the need for educators to engage in ongoing critical reflection on their own cultural biases and assumptions, and to actively work towards creating a learning environment that promotes equity, diversity, and social justice. Culturally sustaining pedagogy also emphasizes the importance of engaging with communities and families as active partners in the educational process.

Narrative Identity and Counter-Storytelling

Identity is not only embodied within the stories a person tells about themselves, but also encompasses the actual act of narrating or storytelling (Sfard & Prusak, 2005). Identity is a verb, made and remade through the act of storytelling. The stories are not merely descriptions of a static reality, but rather dynamic constructs that can change over time and context. The narratives serve as constructs that embody someone’s range of experiences, characteristics, and expectations, thereby defining the creation and evolution of one’s personal and social identities. Even more important than telling a story to explore one’s identity is the way that identities are reified and endorsed through the acceptance, validation, and re-telling of these narratives.

Counter-storytelling, therefore, involves sharing stories and experiences that challenge existing dominant narratives and stereotypes, with the goal of promoting a more nuanced and equitable understanding of social issues in order to challenge dominant (and oppressive) narratives (Solórzano & Yosso, 2002). Counter-storytelling is a tool for marginalized communities to highlight their experiences and perspectives, and challenge destructive narratives that perpetuate harmful stereotypes. Through counter-storytelling, individuals and communities reclaim their own narratives and thereby their own identities (Author, 2021).

Together, these theoretical frameworks provide a theoretical foundation for using of digital mathematics storytelling to explore culturally sustaining mathematics stories told by youth within Asian American communities.

Modes of Inquiry

This research proposal uses a community participatory action research and narrative inquiry approach to explore the ways that Asian American youth engage in digital mathematics storytelling.

Community Participatory Action Research

Community participatory action research emphasizes the importance of involving community members in the research process, not just as participants, but as actual decision makers in the research planning and enactment (Kim, 2016; Mirra et al., 2015). This research approach recognizes that knowledge production is not an objective or neutral process, but rather a process shaped by the social, political, and economic context in which it is produced. By using community participatory action research, this research proposal engages with Asian American youth, families, and communities as active participants in the research process.

Narrative Inquiry

Narrative inquiry (Clandinin & Connelly, 2000) is a research methodology that focuses on the stories that people tell about their experiences and how these narratives are their identities (Sfard & Prusak, 2005). This approach recognizes that stories are a powerful mechanism of communicating and understanding complex phenomena that connect to our central humanity. By using digital mathematics storytelling to elicit stories about mathematics, this research project elicits, analyzes, and tells counter-stories crafted by youth and their community and family members that actively combat stereotypes about Asian Americans and mathematics.

Research Participants

The research participants in this proposal were 8 youth who self-identified as Asian American and who lived in a predominantly Asian American community in the Western part of the United States of America. They ranged in age from 9-years old to 13-years old. Each participant engaged in a four-part digital mathematics storytelling workshop focusing on crafting and telling mathematics videos. Because of the use of youth participatory research methodology, each youth storyteller engaged in the research project differently, based on their own agency and ideas about what the research project should be.

Some youth crafted their stories individually over multiple sessions with the research team. Some youth crafted their stories in small groups with each other. Every youth involved elders from their own family and community in crafting the stories. And members of the research team, who identified as Asian American community members, interacted with the youth both as university-based educational researchers and members of the youth participants' communities. Because of this proximity between members of the research team and the Asian American community, all recruitment of participants occurred through already established relationships between the research team members and the Asian American community centers that served as the physical location of the storytelling workshops and screening.

Within the structure of digital mathematics storytelling that the 8 Asian American youth enacted, the research team collected data based on (1) field note observations, (2) informal interviews, and (3) the final stories that the youth created. Additionally, (4) the final showcase community screening of the digital mathematics stories at an Asian American community center was video recorded and analyzed. This final community screening served as a culminating event for family and community members to watch, react, and discuss the feelings and stories surfacing from watching the youth-created stories together.

Analysis

The process of data analysis was carried out in several stages. First, our research team meticulously watched the data and engaged in multiple conversations, fostering a collective understanding of the video stories, conversations, and observations generated throughout the project. These discussions offered diverse perspectives and interpretations, enriching our comprehension of the data.

Next, the team conducted follow-up interviews with the participants to further deepen our understanding of their experiences. This step allowed us to clarify any ambiguities and add layers of depth to our initial interpretations of the data. During this stage, we also engaged in member checking with the participants to ensure that our interpretations resonated with the participants' experiences and perspectives.

Finally, after a rigorous process of data immersion and refinement, the research team engaged in thematic analysis. This entailed a systematic process of coding and categorizing the data to identify themes and patterns. Our primary focus lay on the ways in which the youth

participants actively crafted and framed counter-stories that challenged the model minority myth and their positioning in relation to mathematics.

Researcher Positionality

The first author identifies as a 2.5 generation Asian American, which brings personal experiences of Asian American family and community positioning along different gradients of “Americanness”. The 2nd author identifies as an Asian individual residing in the United States, navigating an ongoing journey of balancing Asian cultural values and ways of thinking with their life in the United States. The 3rd author identifies as a person of color, embodying a spectrum of experiences that revolve around being continually othered seen as deficient in mathematics. Our shared lived experiences fostered a sense of connection with our youth participants, enabling us to establish trust through the recognition and validation of shared experiences, good and bad.

However, we must also acknowledge and be critically aware of the positional power we held, as adult researchers within a university setting. We recognize that this power dynamic influenced the way our participants engage with us. We also recognize that our experiences as not identical to those of our youth participants. We may have experienced our own set of challenges, but we must remain attuned to the ways in which the participants’ experiences may differ from, and at times echo, our own.

Results

The use of digital mathematics storytelling elicited several counter stories around mathematics that challenge the ways that Asian American youth position themselves and their communities. While we do not have space to fully describe our findings here, we hope this glimpse of the stories created within this research project shows the intricacies of Asian American mathematics identities that came out through the digital mathematics stories shared.



Figure 1: Screenshot from a participant’s Digital Mathematics Story exploring the mathematics of a shared counting sequence within a community Kung Fu practice.

Theme 1: Mathematics in the Culture

The first theme of *mathematics in the culture* focused on the way that youth positioned mathematics as more than just the numbers and formulas they work with in school. By telling stories in which they detail the very use of mathematics in their own communities, several youths showed that mathematics in their own worlds was an active and constant construct that they were very aware of. For instance, in Figure 1, a youth presented the precise ways that their entire community kung fu studio counted together in English while enacting their routine. This use of

choral counting as a mechanism of unity and cohesion shows the ways that very simple mathematics, such as counting, was a constant within the rich lives of the Asian American community. Additionally, the conversations during the community screening highlighted the ways that these shared experiences, such as kung fu, created historical ties within the community, as the basics sequences of kung fu practice have survived for multiple generations, with a history more than 4,000 years old. One elder shared that the counting sequence that their grandchild enacted in this practice was the same counting sequence that he had enacted as a child more than 70 years ago.



Figure 2: Screenshot from a participant's Digital Mathematics Story exploring the crafting of intricate designs in boiled sugar for a traditional Chinese dessert.

Theme 2: Asian American Creativity

Several participants also shared the ways they saw mathematics in culturally sustaining practices that were actively different than the mathematics they felt they were often positioned within. For example, in Figure 2, a participant detailed the mathematics they noticed during a Lunar New Year celebration featuring an artisan crafting intricate animals out of boiled sugar. In this case, the participant detailed the intricate mathematics involved in the melting of sugar, the timing of how long the sugar will stay malleable, and the precision needed by an artisan in molding this sugar into intricate animal patterns in a traditional dessert. The discussion during the community screening opened up ideas about how Asian Americans engaged in multiple artistic practices that involved creativity, ingenuity, and tradition, which countered the stereotypes of regurgitation and precision often associated with mathematics achievement. Simply put, the myth of Asian Americans as non-creative and non-artistic was one that all youth participants felt and wanted to counter.



Figure 3: Screenshot from a participant’s Digital Mathematics Story exploring the feeling of loss following the deadly Monterey Park shooting.

Theme 3: Mathematics as a Mechanism for Processing Violence

Several participants shared poignant narratives of the trauma they had experienced, notably in response to attacks on their Asian American community. These traumas highlighted the impact of Anti-Asian hate onto the youths’ mental health—an area often overlooked in Asian American students. A poignant example of this trauma came when a participant analyzed the devastating effects of the Monterey Park shooting of 2023, detailing the lost lives and opportunities and the survivors’ experiences (Arango et al., 2023). These narratives resonated deeply with participants and their families, giving voice to intergenerational stories of feeling “hunted” and “attacked” in the United States solely due to their Asian American identity.

These stories led to conversations about how the current wave of Anti-Asian hate was not new; this violence was embedded in the fabric of our country since its inception, as evidenced by historical instances such as the Japanese internment camps and the Chinese Exclusion Act (Takaki, 1998). Therefore, while these violent episodes caused significant distress among the youth, this research project offered an opportunity to delve into Asian American history and address violence and trauma head-on, as opposed to disregarding or minimizing it.

While the initial aim of this research project was not specifically to aid participants in processing trauma, the stories and ensuing discussions made it evident that participants required a safe space not only to tell these stories but also to acknowledge the collective trauma resulting from these events.

Discussion

Utilizing digital mathematics storytelling as a medium to delve into culturally sustaining mathematics narratives in Asian American communities via community participatory action research not only fostered a more nuanced understanding of Asian Americans, but also actively disputed detrimental stereotypes associated with mathematics. A scan of existing literature revealed a dearth of similar research, underscoring the importance and novelty of this project in illuminating previously invisible perspectives about Asian American youth and mathematics.

By creating a platform for counter-stories that challenge the model minority stereotype, the youth-produced video stories and subsequent discussions underscored the diversity of experiences and viewpoints within Asian American communities. In essence, these stories served as platforms for youth expression, allowing participants space to reclaim control of harmful

narratives about their identity and to counteract stereotypes. These counter-stories thus dispute prevalent narratives about Asian Americans and their relationship to mathematics, narratives that often serve to bolster white supremacy and oppressive educational practices (Chen & Buell, 2017).

Through this project, the research team witnessed the transformative potential of collaborative and participatory research methodologies. We not only engaged the youth as active participants, but also embraced the ways they involved their families and community members. We found that centering the experiences and perspectives of community members in the research process unveiled tangible ways that youth and their communities were challenging systemic barriers to their success and agency beyond academic settings.

Nonetheless, we recognize the limitations of this research project. The application of digital mathematics storytelling and community participatory action research does not present a universal solution to the multifaceted issues confronting mathematics education in Asian American communities. Furthermore, given that participant recruitment was primarily facilitated by the researchers' own standing as community members, we acknowledge the potential for sample bias.

In conclusion, we posit that digital mathematics storytelling or any narrative mechanism that prioritizes youth creative agency can facilitate a more nuanced understanding of mathematics education in relation to Asian American communities in the USA. These stories and ensuing conversations serve as potent reminders of the oversimplified and harmful nature of the model minority myth, and that Asian American experiences with mathematics diverge substantially from prevalent portrayals in our field.

Interestingly, while many students initially believed their videos needed to focus solely on mathematics, they discovered the potential to tell deeper stories about identity and their emotional connection to mathematics. The shared their mathematics identities by telling and retelling their stories.

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Proceedings of the Forty-Fifth Annual Meeting of the
North American Chapter of the International Group for
the Psychology of Mathematics Education

Engaging *All* Learners

VOLUME 2: LEARNING

Reno, Nevada

Oct 1-4, 2023

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Citation:

Lamberg, T., & Moss, D. (2023). *Proceedings of the forty-fifth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (Vol 2). University of Nevada, Reno.

ISBN: 978-1-7348057-2-7

DOI: 10.51272/pmena.45.2023

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