Make Cultural Assets Count in Community College Math: Lessons learned from piloting real-life math tasks in a Yucatec Maya School

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I am both a researcher and a community college math instructor. This paper describes how I drew from my six-month ethnographic study in a Yucatec Maya village in the Yucatán to create and pilot a culturally responsive task in a community college math classroom in the US. Results have implications for community college math instructors who want to simultaneously deepen students' conceptual understanding of math topics; illuminate students' cultural assets; and build on students' cultural knowledge.

> *Two Yucatec Maya boys, aged five and nine, want to fly a kite, but they have no money. They engineer a kite using hand-torn, black-plastic garbage bags, salvaged fragments of wood, and medley of red, blue, and yellow cotton twine and fishing line. For an hour, they pilot their construction at the ocean's edge, without adult supervision. They experiment with launches: tossing the kite up against the wind, with the wind, from the top of a stone wall, and from inside an abandoned boat. They innovate and improvise. They lengthen the kite line by adding salvaged beach string; add weight to the tail; and adjust how the kite line is attached to the cross spar. Three times, they extricate the kite from the branches of an Uva del Mar tree (Darling, 2019).*

When these boys arrive in the local middle school, how will math teachers capitalize upon this wealth of practical problem-solving expertise? This scenario is from this my study that found that Yucatec Maya students come to school with a wealth of cultural knowledge around problem solving. However, local schools miss opportunities to build upon these cultural assets during math instruction, as educators rely primarily on government-provided curriculum. When I piloted two math problems that built on students cultural knowledge in this Yucatec Maya school, students preferred drawing from their own funds of knowledge, "sentido común" as they call it, rather than using the preset algorithms provided, "equations" to solve math problems.

Like many studies, my study suggests that incorporating cultural assets into math instruction bolsters a student's sense of belonging, engagement, and ultimately achievement (Darling, 2019; Ezeife, 2002; Jorgensen, Sullivan, Grootenboer, Niesche, Lerman, & Boaler; Lipka, Hogan, Webster, Yanez, Adams, Clark, & Lacy). As math educators in the US, we may not always understand or value the cultural assets that our students bring to class—especially since many educators teach students from backgrounds radically different than their own. As a researcher and a community college math instructor, I drew from lessons learned by designing and piloting culturally-informed tasks in Yucatec Maya classrooms to create a culturally responsive assignment in a US community college math course.

Obviously, it is not feasible for community college instructors to conduct ethnographic studies on their students every semester. Also, students' cultural backgrounds vary widely within a class. However, drawing from my research and teaching experience, I piloted an activity in a community college math classroom that allowed students to solve problems that were culturally relevant to them. In a pre-statistics math class, the very first math class that many community college students take, I assigned the following task for homework:

> *Create, modify, or copy a real-life data set that is either skewed left or skewed right. Use data that is important to you; data you care about.*
> *1) List all the data in the original data set and explain any modifications to the original data.*
> *2) Create the histogram of the data set*
> *3) Explain what real-life conditions cause the data to be skewed left or right.*

Notice that the assignment uses Bloom's verbs that promote higher-order thinking: "create" and "explain". Assigning students to create word problems or data sets that are culturally relevant to them is a way to gather ethnographic information about your students' backgrounds while simultaneously inviting them to celebrate topics that resonate with their core values and cultural backgrounds. Below, I describe two examples of student's work.

A White student, Barbara, from a rural background, modified a data set of wolves in Yellowstone to indicate a skewed-to-the-left data set (Figure 1). She was born in Northern California where she was raised to value a culture of hunting, wildlife management, and outdoor living. She had aspirations to be a game warden. She told us that she graphed the data set of the number of wolves in Yellowstone from 1996 to 2018 on a histogram, because she cared deeply about wolves. Wolf repopulation initiatives started in 1996. However, she found that the graph was a bell-shaped curved and not skewed. Then, she told us that she decided to create a histogram that included the years from 1926 to 1996, because in 1926 there were record numbers of wolves in Yellowstone, but virtually none between 1926 and 1996. Her face looked sad when she talked about how wolf populations dwindled after 1926 for decades due to over hunting. However, adding this 1926 data made the data set more skewed to the left.

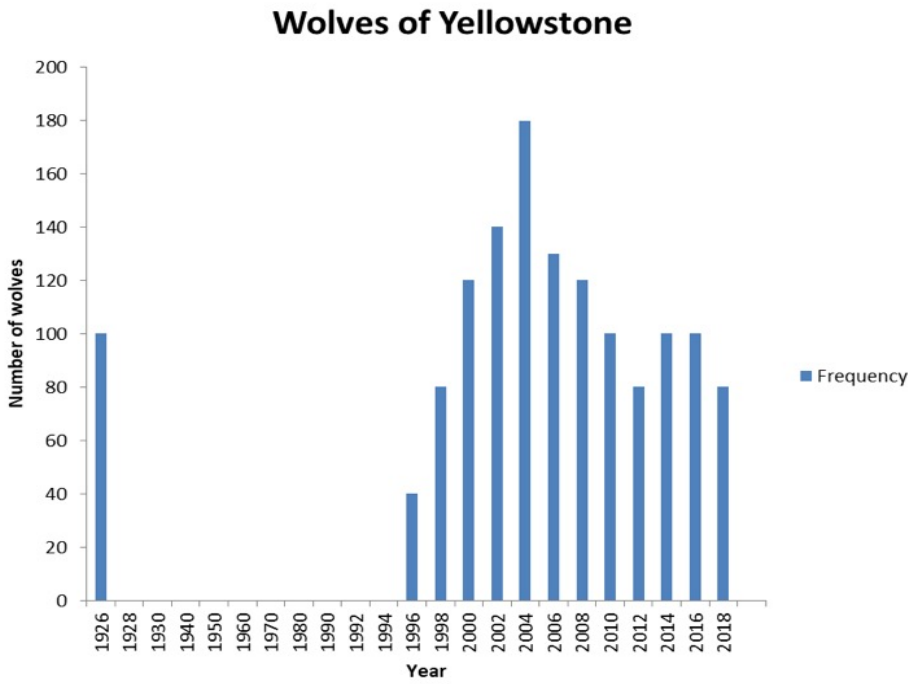

Figure 1: Barbara's Wolf Histogram

In a second example, a Latinx student, Anahi, created a data set by creating a family tree that included 45 sisters, brothers, living parents, nieces, and nephews (Figure 2). She was born in México and many of her family still lived there, far away from her. She smiled when she explained that making a family tree was how she held her family close, as many of them still lived in México. She carefully wrote the ages of each of her living relatives next to each name on the family tree. She created the data set and a corresponding histogram. However, she realized that the data set was not skewed, so she considered how she could modify the data set to make it skewed. In the end, she added the ages of her grandparents even though they had already passed. This made the data skewed to the right a little.

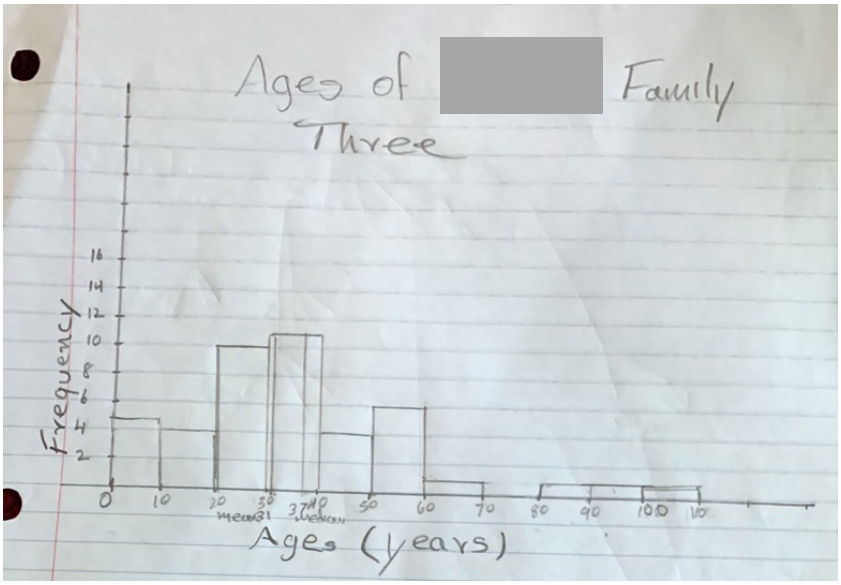

Figure 2: Anahi's Family Tree

Students reported enjoying the assignment, although they said it was hard to create or modify the data set to make it skewed. On assessments, students demonstrated an improved understanding of skewedness, histograms, and the relationship between real-life situations and shapes of data sets. The class seemed to grow closer to each other when they heard about the core values of their classmates. While it is not always easy to create culturally responsive math tasks, much research indicates that culturally responsive math instruction is important to improve students' sense of belonging, engagement, and achievement. As educators, we do not magically know the cultural background of all of our students, so it can be challenging to teach culturally relevant math activities. However, we can solicit information about students' core values and culture by asking them to create word problems or data sets that are meaningful to them. In this way we find out about who students are as well as invite them to embrace their cultural and core values during math instruction. In math classes, faculty can carefully craft tasks and assignments that deepen students' conceptual understanding of the topics while at the same time illuminate their cultural assets and build on their cultural knowledge.

References:

Darling, F. (2019). Incorporating cultural assets in Yucatec Maya math classrooms. Opportunities missed? *Journal of Mathematics and Culture.* 13(1), 20-60.

Ezeife, A. N. (2002). Mathematics and culture nexus: The interactions of culture and Mathematics in an Aboriginal classroom. *International Education Journal*, *3*(2), 176-187.

Jorgensen, R., Sullivan, P., Grootenboer, P., Niesche, R., Lerman, S., & Boaler, J. (2011). *Mathematics in the Kimberley: Reforming mathematics in remote Indigenous communities.* Queensland, Australia: Griffith.

Lipka, J., Hogan, M. P., Webster, J. P., Yanez, E., Adams, B., Clark, S., & Lacy, D. (2005). Mathematics in a cultural context: Two case studies of a successful culturally based mathematics project. *Anthropology & Education Quarterly*, *36*(4), 367-385.