

CONNECTING MATHEMATICS TO THE REAL WORLD: ONE GROUP OF ELEMENTARY MATHEMATICS TEACHERS' EXPERIENCES

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In this study, we examined one group of elementary mathematics teachers' experiences in connecting mathematics to the real world. The professional development collaboration was designed to connect mathematics to the real world, particularly connecting to students' funds of knowledge. We interviewed seven elementary teachers about their experiences in connecting mathematics to the real world and to what they knew about their students. We categorized the teachers' responses resulting in the Connecting Mathematics to the Real World framework. Our findings show that while almost all teachers had implemented typical word problems as a way to connect mathematics to the real world, none had incorporated contexts relevant to their students' lives. However, most of the teachers expressed interests in developing lessons that were more relevant to their students' lives.

Keywords: Social Justice, Culturally Relevant Pedagogy, Elementary School Education, Equity, Inclusion, and Diversity.

Purpose of the Study

The purpose of this study is to examine one group of elementary mathematics teachers' experiences in connecting mathematics to the real world before engaging in a professional development. Research question: *What are teachers' experiences in connecting mathematics to the real world at one elementary school?*

Literature & Theoretical Framing

What Does Connecting Mathematics to the Real World Mean?

Extant scholarship has explicated several ways that teachers can connect mathematics to the real world. These include a) situating problems in story contexts (typical word problems), b) analyzing real-world data or real-world situations (that may or may not matter to the students per se), or c) connecting to students' funds of knowledge (both mathematically and with the context). We discuss each of these below.

Word/Story problems. One common way to connect mathematics to the "real" world is through story problems (Gainsberg, 2008). However, these story problems are often created with

common but unimportant contexts, for example, a focus on “apples, puppy dogs, and ice cream” (Koestler, 2012) rather than on issues students really care about. These word problems might be about 2 trains that meet somewhere or purchasing 42 watermelons and so forth. Though the math is put in a story context, these problems are often simply exercises to do, not real problems that students are motivated to solve. When asked to create word problems with real-world connections, most teachers tend to focus on the math rather than the context (Lee, 2012).

Analysis of real data, bring in real-world issues (not necessarily relevant to the students in the class). Teachers can bring in real data or real-world issues to connect mathematics to the world (Gainsberg, 2008; Gutstein, 2006). However, this data may not always be meaningful to students or focus on problems they care about solving. These data might focus on measuring physical objects, census data, examining a newspaper article, etc. The problem contexts or data may be designed to support students’ development of a sociopolitical disposition (Frankenstein, 2012; Gates & Jorgensen, 2009). However, teachers may not use a critical lens when implementing such tasks (Bartell, 2013; Lee, 2012)

Connecting to students’ funds of knowledge (FoK). Another approach is creating problems designed to build on children’s mathematical thinking (CMT) and Cultural Funds of Knowledge (CFoK) (González et al., 2005; Turner & Drake, 2016). Problem types that fall into this category connect to the students’ mathematical knowledge bases as well as to the students’ and their communities’ interests, experiences, and backgrounds (Civil, 2007; Wager, 2012). Turner and colleagues (2012) studied how prospective teachers (PTs) develop their understanding of students’ multiple mathematical knowledge bases. As PTs develop meaningful connections between students’ multiple knowledge bases and their instruction, they can “facilitate ongoing and purposeful incorporation of multiple mathematical knowledge bases” (p. 78).

Prior frameworks (Gainsberg, 2008) for connecting math to the real world have distinguished between the first two but have not yet incorporated the third: an explicit focus on the students’ FoK. We build on the first two categories and add students’ FoK to emphasize the relevance of students’ lives to create the framework for this paper (see Table 1).

Methods

Participants and Contexts

Seven elementary teachers from one public elementary school in the Pacific Northwest of the United States participated in the study. These teachers were at the beginning of a professional development collaboration designed to connect mathematics to the real world based on connecting to students’ funds of knowledge. The teachers spanned grades K-5, a student success coach, and a special education teacher.

Data Collection

The research team conducted individual 30-minute semi-structured interviews with each participant. Interview questions focused on the teachers’ experiences in connecting mathematics to the real world and what they knew about their students, the students’ families, and the community. For example, we asked:

- Tell me what you know about your students’ interests and experiences outside of the classroom.
- Tell me about your students as math learners.
- What experiences, if any, do you have with connecting math to the real world?
- What are some real-world topics that you are interested in exploring with kids in math?

The interviews were recorded and transcribed.

Analysis

Analysis began with one research team member carefully reading all the transcripts and highlighting keywords and sentences from each transcript to fit into existing categories: Typical Word/Story Problems, Analysis of Real Data/Bringing Real-World Issues, Connecting to Students Funds of Knowledge. During this same initial reading, the researcher also highlighted new keywords that indicated new categories. For example, several teachers highlighted that they followed the curriculum and as such, we added “following curriculum” as a category. Another category that emerged was “cross-curricular connection to the real-world outside mathematics.” Once the initial categorization was completed, additional research team members discussed the categorizations and came to an agreement on all categorized segments. Below we discuss each theme.

Results

Table 1 shows the summary of the teachers’ experiences in connecting math to the real world. Below we discuss each theme.

Table 1: Teachers’ Experiences in Connecting Mathematics to the Real World

Teachers’ Experiences in Connecting Mathematics to the Real World	Number of Teachers
Following Curriculum	4
Typical Word/Story Problem	6
Analysis of Real Data/Bringing Real-World Issues That Might Not be Relevant to Students Personally	2
Connecting to Students’ Funds of Knowledge	0
Bringing the World into the Classroom (Cross-Curricular Connection to the Real World Outside Mathematics)	3

Following Curriculum

Four teachers began their responses by mentioning that their curriculum provides connections between math and the real world and they followed it. Teacher A mentioned, “I kind of just go with like... the stories in the curriculum.” Teacher F said, “I know that the curriculum attempts to do somewhat of it.” These four teachers’ experiences with typical word/ story problems were closely related to the curriculum. The three teachers who did not mention the curriculum each shared at least one example in another category.

Typical Word/Story Problem

Six teachers shared their use of the typical word/story problems as their experiences in connecting math to the real world. Teacher A and Teacher F used bunk beds and apple boxes for 10 frames since the curriculum provided them. Teacher A said, “Our first unit was like bunk beds and apple boxes, so we are really focusing on 10 frames and manipulating numbers within a 10 frame.” Some teachers considered using students’ names in the word problems as a way of connecting math to students: “I’ll pick like some student names and put it in the word problems” (Teacher C) and “I’ve also tried to connect problems to students lives actually using students in the problems just throwing out names” (Teacher D). Teacher E shared that he used ice cream shops and shopping mall contexts for decimal operations. He said, “ice cream math and shopping mall math or whatever with the decimals to kind of like help them through things a little bit.”

Analysis of Real Data/Bringing Real-World Issues That Might Not be Relevant to Students Personally

Two teachers shared analysis of real data or bringing real-world issues as their experiences in connecting math to the real world. Teacher E said he has implemented the ‘Million Dollar Project’ many times. He said, “I sent them to a site for houses... gave them million-dollar... they had to spend exactly a million dollars or else they don’t get their million dollars.” Teacher G shared her experiences in creating a small classroom economy: “They have to come in and they have to do the work, do the math, show their work, explain, help someone, and then you are paid. You are a math consultant, and so they have their own banks... at the end of the week, they can buy a goodie.”

Connecting to Students’ Funds of Knowledge

None of the teachers shared their experiences in connecting math to students’ funds of knowledge. However, six teachers shared that they want to find and implement real-world connections that are relevant and connected to their students on a personal level (their interests), as well as family and cultural levels.

Bringing the World into the Classroom (Cross-Curricular Connection to the Real-World Outside Mathematics)

Three teachers shared their experiences in bringing the real world into the classroom outside mathematics. When Supreme Court Justice Brown Jackson was confirmed, Teacher A introduced the confirmation debate to her students. Students read about the story of the justice and saw the picture of the Supreme Court Justices. She commented that “I had not thought about how to bring math into that but I bet we could figure out a way.” Teacher C shared her experience in scavenger hunts: “I’ve done scavenger, like a nature scavenger hunt, like finding shapes in nature.” Teacher E’s students were interested in Pokémon Cards, so he regularly provided time to his students for Pokémon cards trading.

Conclusion and Discussion

In response to our research question ‘*What are teachers’ experiences in connecting mathematics to the real world at one elementary school*’ we found that while almost all teachers had implemented typical word/story problems as a way to connect mathematics to the real world, yet none had used contexts relevant to their students’ lives. However, most of the teachers were interested in developing lessons that would be more relevant to their students’ lives. Teachers A and D explicitly stated that they were interested in making their mathematics lessons relevant to their students. Teacher B was interested in culturally relevant and social justice related mathematics lessons. Teacher C wanted to develop lessons related to time and money because her students showed interest in time and money. Teacher E was aware of his students’ interests outside of mathematics, but he was more interested in how to connect mathematics to his own interests to make it real-world mathematics. Teacher F expressed her interest in connecting math lessons to students’ cultural and family heritages. Teacher G shared that she wants to help her students to understand how math is in their daily lives.

Understanding how teachers think about connecting mathematics to the real world was important as we began our professional development collaboration. Just as we wanted our teachers to build on their students’ funds of knowledge (González et al., 2005), we wanted to build on the teachers’ funds of knowledge when working with them. Knowing where they started helped us develop an opening activity to develop a shared understanding of how we thought about connecting mathematics to the real world.

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