Elementary Teachers' Perspectives About the Tensions of Teaching Mathematics Through Art and Music

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In order to help more children to be successful in mathematics, teachers are searching for new ways to leverage children's out-of-school knowledge and experiences while teaching mathematics, specifically with regard to contexts of art and music. The following paper details a subset of a larger phenomenological pilot study about seven elementary teachers as they worked with three artists to craft mathematics lessons that incorporate art and music. The presentation will detail how Kara and Miranda, two third grade teachers, discussed the tensions of teaching elementary mathematics through art and music. Implications for future research and practice regarding the practicality these lessons will be discussed.

Keywords: Elementary School Education, Instructional activities and practices, Teacher Education-Inservice/Professional Development

Objectives and Background for the Study

Research in mathematics education suggests that many students, particularly those in traditional classrooms, feel disconnected from their in-school mathematical learning (Greer, Mukhopadhyay, Powell, & Nelson-Barber, 2009). To help more students be successful in mathematics, teachers can explicitly incorporate students' out-of-school knowledge and experiences into their practice (Turner, Gutierrez, Simic-Muller, & Diez-Palomar, 2009). Research frameworks such as those on culturally responsive mathematics teaching (Bonner & Adams, 2012; Gay, 2000), children's multiple mathematical knowledge bases (Turner et al., 2012), and STEAM education (Science, Technology, Engineering, Art, and Mathematics) has provided concrete examples of how teachers might contextualize their practice in the familiar experiences of their students. Research-based frameworks that leverage children's familiar experiences and knowledge for teaching mathematics are particularly important for children who are not typically successful in traditional classrooms (Greer et al., 2009). When teachers use more authentic, non-traditional contexts of art and music, as related to the diversity of children's particular cultures and native languages, more students might learn mathematics more easily (Courey, Balogh, Siker, & Paik, 2012). The purpose of this study was to explore the perceptions of seven elementary teachers as they learn to craft tasks, related to mathematical concepts of fractions and geometry, within Latin@ children's knowledge and experiences with art and music. (It should be noted that the author is using "Latin@" specifically to honor those who do not identify as male or female.) The guiding research questions for this pilot study ask: (1) Prior to the Te'ALaMO (Teachers, Art from Latin@ cultures, and mathematical MOdeling), how did teachers utilize art and music as a context for teaching elementary mathematics, and (2) during the Te'ALaMO, what affordances, tensions, and/or implications for future practice do the teachers describe when considering art and music as a context for teaching elementary mathematics? For this particular brief research report, the authors will focus on the experiences of two third grade colleagues, Kara and Miranda.

Methodology

Te'ALaMO was designed as a qualitative, phenomenological study (Creswell, 2007) that explored the experiences of seven in-service teachers as they learned from a musician, an actress, and a muralist about how to integrate elements of art and music in their mathematics instruction during the summer of 2014. The setting for the study was in a large city in a south-central area of the U.S. where the author is a mathematics teacher educator at a large urban university. Three pre-K, three third grade, and one fifth grade teacher were purposefully recruited for the study from schools that serve large populations of Latin@ children and non-native English speakers and that were nearby a Latin@ community cultural arts center, where the workshop was housed. Prior to the workshop, the teachers discussed their beliefs and prior experiences about using art and music to teach mathematics and then worked on activities with the artists that situated mathematics within playing mariachi music, acting, and designing murals. The research team conducted focus group interviews and collected observational field notes of the activities, teachers' quick reflections at the conclusion of each day regarding their experiences, and an optional demographic survey about the teachers' backgrounds. The researchers also created transcriptions of video and audio recordings of the participants during the workshop.

Because phenomenological research is described through the perspective of the participants, findings based on the data analysis emerged from the teachers' experiences during Te'ALaMO. Data analysis began by reading the transcripts and observational field notes and identifying the ways in which teachers discussed how and why (or why not) they might use art and music as a context for teaching mathematics. Memos (Creswell, 2007) about these emerging themes were created for each day of the workshop and across all three days. The researchers compiled and compared their detailed memos about the teachers' experiences regarding the affordances and tensions of using art and music to teach mathematics as a way of conducting member checks of their findings.

Preliminary Findings

Over the course of the three-day workshop, the teachers learned about mariachi music, performance art, and murals with respect to teaching elementary mathematics concepts such as rational number operations (e.g., equivalent fractions, ratios and proportions) and transformational geometry (e.g., shape attributes, patterns, reflections). As an example, the musician and teachers compared how the structure of music note values (e.g., whole notes, half notes, and quarter notes) was similar to how elementary teachers might introduce the meaning of creating and operating on fractions equivalent to one whole (e.g., one whole note is the same duration as two half notes or four quarter notes when played at the same tempo; 1 = 2/2 or 4/4). Later, the Chicana actress described the nine equal sectors of a performance stage and how this these sectors referred to the actors' relative stage position. Finally on the last day, the muralist extended the discussion about rational numbers by helping the teachers to use proportions and scale to replicate a small picture on a larger poster board.

Many of the teachers like Kara and Miranda, two third grade teachers in the workshop, already utilized some elements of art and music in their daily practice as a mathematics teacher (e.g., children illustrating mathematical representations through drawings, singing songs to help memorize basic facts, students learning about area and perimeter by creating their name in block letters on graph paper). Throughout the workshop, Kara and Miranda were two vocal participants who discussed at length about how the challenges and tensions that they might face if they wish to situate more of their mathematics teaching within the contexts of art and music.

Preparing Students for Standardized Testing While Developing Their Flexible Mathematical Thinking

Although Kara and Miranda discussed many ways that they used art and music to address elementary mathematics concepts with their students, they still recognized that the pressures of standardized testing could be in conflict with their goal to help children develop a flexible understanding of mathematics. Because Kara and Miranda taught in a grade level that was subject to statewide standardized testing, they assumed that other colleagues might not agree that art and music could be a viable context for helping children to learn mathematics. Specifically Kara stated:

> It's hard to sell something like this [teaching mathematics through art and/or music] to other people if you don't have, like, evidence. You know? Especially, when you teach a [name of the standardized test] grade. Oh my God. It's…it's, well 'how's it going to affect the data?' That's like [laughs], always on everybody's mind. But, just with, especially with the first day Te'ALaMO, the [mariachi] music, I could see how much higher order thinking is involved when you're having to count and clap…

In this moment, Kara concluded that she felt the pressure of using art and music to teach elementary mathematics when each moment of her practice as a teacher needed to be tied to some measurable outcome or goal as it related to the state's standardized test. Kara continued her thought by claiming that even though she felt pressure of the standardized test, she still maintained her belief that art and music could help her students to develop a flexible understanding of mathematics. She stated that

> I think a lot of, well, even what we're trained on is that sometimes it's you're teaching the child how to think in ways that they're not used to, and sometimes that's hard, you know? They're being assessed in a certain way, but we're training them to think this one way, and then it's hard for them to think differently. So, giving them all these avenues to express the same sort of idea, you know, I think is important. And I think, you know, as teachers when we come to things like this, we have to be advocates for it at our own campus, you know? I think it's hard to do at third, fourth, and fifth grade, because… You can get other teachers on board with this sort of model [of teaching mathematics through art and music].

Kara concluded that she could address this tension of creative teaching while preparing her students for the yearly standardized test if more of her colleagues adopted non-traditional methods of teaching mathematics by leveraging elements of art and music.

Finding Resources for Implementing Mathematics Lessons that Incorporates Art and Mathematics

Miranda, Kara's colleague at the same school, agreed with Kara's belief that art and music could serve as a flexible context and proposed that she could also address the required elementary standards across multiple content areas. At first, Miranda suggested that art and music " might open some avenues for some of them [the students], you know, and show them how the art can be integrated into math, and engineering, and science, and you know, you can find it everywhere. I think it's, it's fantastic for the kids." Then after the muralist concluded her session on using proportions and scale to create murals from smaller pictures, Miranda reiterated her perception on the final day of the workshop when she stated that

> And I find that I use art, I integrate it a lot with social studies because it's easier…like when we're studying, let's say Cinco De Mayo You know, where we can talk about the history and then we can make something. They make it, a piñata. And so I have two grades. I have my social studies, you know my actual… about the history, and what they wrote in their journals, you know, that grades then I also have an art grade. But now with this [the mural lesson in the workshop], I can integrate it with math.

Miranda described how she already leveraged her Latin@ students' particular students' out-of-school knowledge and experiences (e.g., Cinco De Mayo and piñatas) while teaching social studies, history, art, writing. Now after the mural activity, Miranda could see how she might use a mural about Cinco De Mayo and piñatas that could help her address her mathematics standards as well.

Shortly after the muralist's activity, Kara and Miranda mentioned yet another challenge to implementing similar lessons like the mural activity with their students. Specifically, Kara stated "materials and supplies. Some schools are, you know, really, uh, considered wealthy, right? You get to go into the supply room and get whatever, and then, not all campuses are like that." Because all of the teachers who participated in the workshop worked at schools that served children from mostly economically challenged communities, Kara in particular recognized that although she could teach a lesson that addressed multiple state standards by utilizing elements of art and music, she would have a challenge of finding enough supplies and resources for these lessons.

Implications and Conclusion

As teachers find new ways to support their students' mathematical thinking, they are exploring new contexts by which to connect their lessons to children's out-of-school mathematical knowledge and experiences (Gay, 2000; Wager, 2012). Findings from this study suggest that elementary teachers are working to negotiate both the inherent challenges and potential opportunities for situating their instruction within the contexts of art and music. More research is needed to explore the potential tensions and challenges that teachers might face if they elect to use art and music as a context by which to teach mathematics, particularly with the growing popularity of STEAM education. Furthermore, more research is needed explore how teachers can successful negotiate the challenges with the affordances of using art and music to teach mathematics so that more children develop a flexible understanding of mathematics that is connected to their out-of-school knowledge and experiences.

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