

Student-Created Math Walks in Informal Learning Spaces

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Abstract: Math walks are a form of inquiry learning where students can observe and create mathematical meaning from their everyday surroundings. Here we report on a study of 5th and 6th graders in an informal learning setting where they create and present their own math walks covering concepts of ratio, scale, and proportion. The students may have developed more positive attitudes towards math and were able to meaningfully engage with powerful math ideas.

Conceptual Framework

Much of the research in informal math learning has examined how people use math in their everyday life (e.g., Civil, 2007; Nunes, Schliemann, & Carraher, 1993; Walkington et al, 2014). There is a lack of research on math in designed informal learning environments (Pattison, Rubin, & Wright, 2017), although this is a growing area of interest (Mokros, 2006). Math walks, or “math trails” as they are sometimes called in the literature, are walks that learners go on to experience and bring out the mathematical properties of their surroundings – including art, architecture, and nature (e.g., English et al., 2010; Richardson, 2004). Math walks may trigger and maintain students’ interest in learning mathematics (Hidi & Renninger, 2006), increase math ability beliefs (Perez-Felkner et al., 2017) and lower math anxiety (Bai, Wang, Pan, & Frey, 2009). They also may allow students to engage meaningfully with math concepts, including using problem-posing as students are engaged as the creators of their own math walks (Wang, Walkington, & Dhingra, 2021). Creating walk stops can be an “on ramp” to learning math concepts that begins with students’ lived experiences. In the present study, we investigate the following research questions: How does experiencing and creating math walks stops allow learners to engage meaningfully with mathematical ideas? How does it impact their math interest, math ability beliefs, and math anxiety?

Method

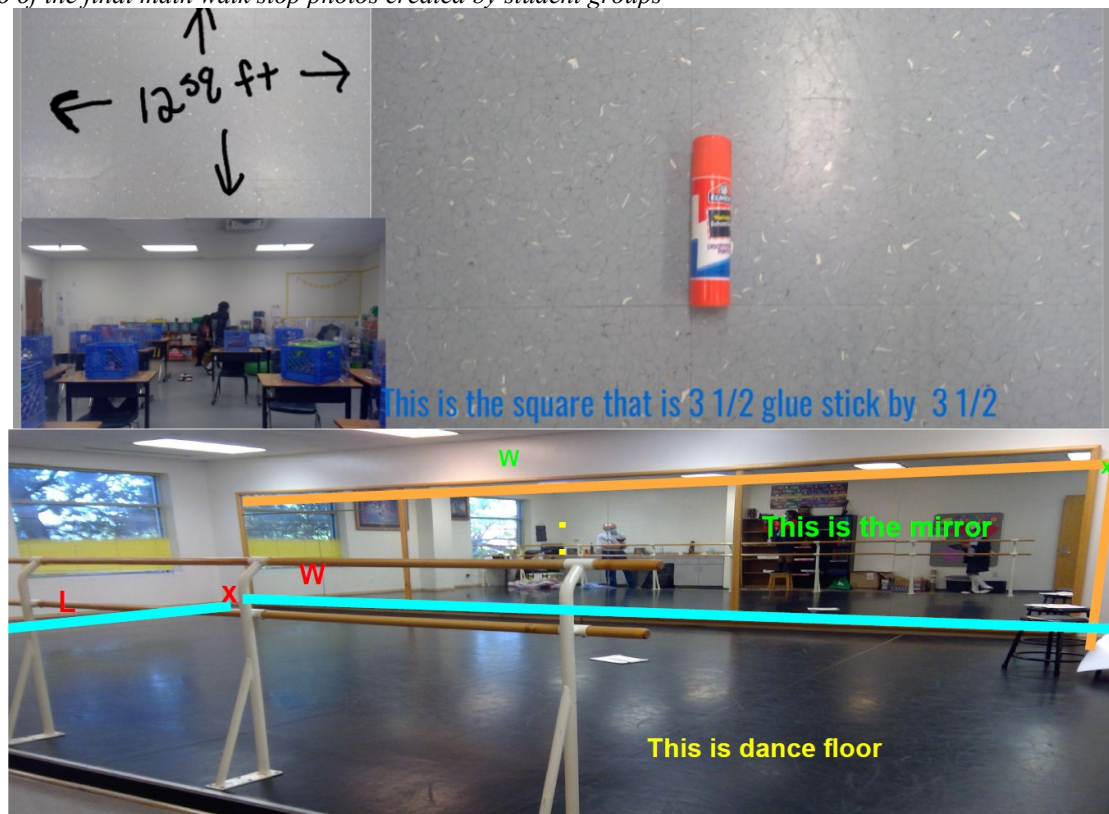
The study took place at a Community Center with ten 5th and 6th grade students participating after school over 4 1-hour periods. Nine students identified as African-American and 1 as bi-racial, with 2 males and 8 females. The math walk lessons focused on issues of ratio, proportion, and scale, and was facilitated by two teachers who taught math at the school associated with the community center. Students first went on a math walk at the Community Center that had been co-constructed by students at the Center and researchers and video-recorded by a professional videographer, starring the students. Then they worked in groups of 3 to create their own math walk stop, using a process where they first would notice and make observations, then brainstorm different questions they could pose given their observations, and then choose one question to pursue. They would create the walk stop by taking and annotating pictures and giving a formal presentation of their stop to club members and other stakeholders. Students took previously-validated pre- and post-surveys measuring math interest, anxiety, and ability beliefs.

Results and Conclusion

Although none of the pre-/post differences reached statistical significance, effect sizes were examined given the small sample size and likely lack of appropriate power. Results suggest an increase in students’ math interest (from 3.9 to 4.5 on a 5-point scale, $d = 0.75$), an increase in math ability beliefs (from 3.6 to 4.2 on a 5-point scale, $d = 0.60$), and a decrease in math anxiety (from 2.4 to 2.0 on a 5-point scale, $d = 0.46$). An examination of students’ final presentations and their artifacts (Figure 1) revealed the novel and creative ways in which they were experiencing math in their surroundings. They engaged with issues of ratio in the dance room of the Center, posing questions about the size of the mirror versus the size of the floor. Another group examined how glue sticks could be used to create an informal measurement unit to better understand the size of a classroom at the Center. During their post-reflections, students highlighted how much they appreciated the collaboration and the freedom to select sites and mathematical ideas to focus on and explore. They also readily pointed out strengths of their peer’s work. Math walks seemed to have immediate, positive impacts on kids’ views of mathematics and the worlds, but an important question is how and whether this effect could be sustained. In current work, we are also examining video footage of student discussions. We are interested in the kinds of support it takes to move students to create more novel walk stops that differ substantially from the examples they saw in the professionally-made videos, and that more strongly express their personal mathematical curiosities as they interact with the world around them.

Figure 1

Two of the final math walk stop photos created by student groups



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