The Role of Context in Adult Undergraduates' Problem Solving

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For this poster, we define adult learners as those who have had significant time away from school mathematics before returning to undergraduate mathematics learning. Based on the first author's prior work with adult learners, she became interested in how adult learners might leverage their experience in their adult professional and personal lives to better understand mathematical ideas. To pilot this type of exploration, she designed two tasks with similar mathematical structure but set in different real-world contexts. This design was informed by existing work, which shows students bring prior experiences to the undergraduate classroom, but often don't see their out-of-classroom experiences as relevant to their classroom work (Graham et al., 2000; Jameson & Fusco, 2014). Also, others have noted that the nature of the context can inform student reasoning in a task (diSessa, 2018; Thevenot, 2017). In light of this, our goal was to consider in what ways adult learners approached these similarly structured mathematical tasks, and in what ways the contexts of the scenarios influenced their problem-solving.

We conducted clinical interviews with two adult learners using missing value proportion tasks. We see these tasks as both mathematically fundamental, and likely to connect to adult learners' prior experiences, since proportional reasoning is one of the most common math applications in everyday life (Doyle et al., 2015; Hilton et al., 2016; Kontogianni & Tatsis, 2019).Our tasks were a Baking Task and a Traveling Task, which read, "Matthew is baking a cake. The recipe calls for 2 cups of flour and 3 teaspoons of vanilla. If a scaled-up version of the recipe calls for 7 cups of flour, how much vanilla should Matthew use?" and "As Buddy walks to school at a constant speed, he travels 8 feet in 3 seconds. How long will it take Buddy to walk 20 feet?" From an expert point of view, each task includes a given ratio and one value of another ratio, with the question asking for the missing value of the second ratio. We analyzed how two adult learners (1) solved each task, (2) thought about the similarities and differences across the two tasks, and (3) reflected on their solving processes.

For (1), we identified five different ways they solved the task. We characterized differences in terms of the main ratio the student leveraged and how they leveraged the ratio. By main ratio we mean whether (a) the student used the two unlike unit data (e.g., 8ft to 3 sec) as the main ratio and then tried to match that ratio or (b) the student used the two same unit data as the main ratio (e.g., 8ft to 20 ft) and then tried to match that ratio. Both participants had one solving method for the Traveling Task, with Travis leveraging a same unit ratio, and Jessica leveraging an unlike unit ratio. In contrast, on the Baking Task, both produced multiple solving paths and leveraged both unlike unit ratios and same unit ratios. With regards to (2) and (3), the students initially did not perceive the tasks as the same, primarily because they used different solving paths for the two tasks. However, upon reflection Travis noted that the same strategy would have applied to both saying, "I could have set them up the same way." With regards to the role of context, the Travel Task had similarities to problems in a math course both participants recently completed, and they both referenced school math solving methods in their reflections. In contrast, while solving the Baking Task, Jessica leveraged her prior cooking experience saying, "What if I was actually baking, what would I do?" We note that both the learner's solving approaches and their reflections seemed to be influenced by the context itself and their experience with the context.

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