DEVELOPING PROSPECTIVE TEACHERS' REPRESENTATIONAL FLUENCY OF WHOLE NUMBER MULTIPLICATION USING ARRAY REPRESENTATIONS

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Representational fluency, the ability to make "connections among mathematical representations to deepen understanding of mathematics concepts and procedures" is an important aspect of building problem-solving skills (NCTM, 2014, p.10). From our experience teaching mathematics content courses for prospective elementary teachers (PTs), we have found that PTs often struggle to make connections between different models of multiplication, which is supported by prior research (Lo, et al., 2008). To attend to this issue, we designed a series of multiplication tasks (see, Olanoff et al. 2018). In this poster we present findings from our second round of implementation with the goal of deepening PTs' specialized content knowledge of multiplication by fostering representational fluency and connecting representations to sense-making procedures.

Our sequence of tasks started with presenting PTs with an 29 x 23 array grid, followed by subsequent tasks. Our goals for these tasks were for PTs to 1) Utilize the array model to understand that a product can be found by decomposing the array into different regions and combining those regions, 2) Use the strategies of summing and combining in this model to develop the partial products algorithm, 3) Understand the connection between the standard US multiplication algorithm as related to the array model, and (4) Recognize the distributive property as a driving force behind the partial products algorithm. Our analysis showed that we were successful at achieving some of our goals, but that the tasks would require modifications in order to meet others. For example, we found that PTs were successful with breaking the array into different amounts and summing them, but many used chunking that was inefficient, as they did not actually make multiplication easier. In subsequent tasks the PTs were also found to focus on the total number of squares (as 667) in a base-10 representation of the array rather than the connection to the original 29 x 23 grid. In addition, the majority of PTs were unable to create symbolic notations that matched with the way they used the base-10 blocks, indicating that in spite of success with prior tasks they struggled to make the connection between the array model and the standard or partial products algorithms.

Overall, through reflecting on our implementation we learned that we needed to re-consider ways to help PTs focus more explicitly on the two numbers being multiplied in an array, rather than only the total number of units. Additionally, we needed to identify ways to better support them in relating symbolic representations of multiplication to array models, *specifically* to understand how the distributive property manifests itself in the symbolic algorithms (both US standard and partial products) and in the array representations. In our poster, we will share our task sequence, show sample PT strategies and examples that indicated a success in representational fluency and places where PTs struggled.

References

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