Bridging Mathematics and Science: Task Design and Blended Sensemaking

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Mathematical equations are a key part of undergraduate science instruction (Li & Schoenfeld, 2019). Students in science classes have both science and mathematical resources they can use to make sense of mathematical equations (Hammer, 2000). Students who make connections between these resources (engage in blended sensemaking) are better able to solve novel or more complex quantitative problems (Bing & Redish, 2009; Schuchardt & Schunn, 2016; Taasoobshirazi & Glynn, 2009). Little research has been done on affordances and constraints for blended sensemaking of different types of tasks involving mathematics in science classes. **RQ:** How do different tasks on mathematical equations in biology affect the types of blended sensemaking discussed by students?

Incoming biology students participating in a session on mathematical modeling of population growth were recorded as they worked in pairs on a sequence of two mathematical tasks. Varying by session, the first task consisted of one of four variants: DM) developing mathematical equations, CM) comparing two mathematical equations, VR) describing relationships between equation variables, and PS) solving problems following an example. The second task was always the same, modifying an equation from the first task. Recorded discussions for each task (4-6) were coded for types of mathematical and science sensemaking and for blended sensemaking using the Sci-Math sensemaking framework (Zhao & Schuchardt, 2021) by two independent coders (Krippendorf's alpha=.77). Counts were standardized for number of groups, time on task.

Across both tasks, the DM/DM-Modify sequence had the most instances of blended sensemaking (DM=100, DM-Modify=169) while the PS/PS-Modify sequence had the fewest (PS=22, PS-Modify=64). Blended sensemaking was categorized into levels based on the types of connected science and mathematics sensemaking (Kaldaras & Wieman, 2023). Lower level indicated connections between sensemaking about mathematical procedures and rules and identifying variables as components of the scientific system. Higher level indicated connections between sensemaking about the structure/syntax of the equation, the quantitative relationships between variables, or represented mathematical concepts and the scientific mechanisms or patterns of the system. Transitional represented connections between lower and higher levels of sensemaking (one from science and one from mathematics). The modify task in each sequence contained high levels of higher level sensemaking (DM=24, DM-Modify=113; CM=31, CM-Modify=76; VR=24, VR-Modify=67; PS=10, PS-Modify=35) mostly between mathematical structure/syntax and patterns students observed in the scientific system. The DM task had many instances of transitional sensemaking (64), most frequently between sensemaking about arrangement of the variables in the equation (mathematical structure/syntax) and what they represent in the scientific system.

These results indicate that different tasks elicit different levels of blended sensemaking indicating different affordances and constraints for helping students make connections between mathematical equations and the scientific system they represent. These findings have implications for which tasks instructors design to leverage student resources and meet learning objectives not only for science classes where students are working on mathematical tasks but also mathematics classes where students are working on modeling scientific phenomena.

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