# Exploring Impact of Task on Mathematical Sensemaking in Undergraduate Biology

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Mathematical equations are a key part of undergraduate biology instruction (Cohen, 2004). While biology is often perceived as the refuge of the math averse (Steen, 2010), students in biology classes have mathematical resources they can use to make sense of mathematical equations (Schuchardt & Schunn, 2016). Sensemaking has been defined as using pre-existing knowledge or skills to figure out a problem (Martin & Kasmer, 2009; Odden & Russ, 2019). Five types of sensemaking in mathematics have been identified (Zhao & Schuchardt, 2021). Theoretically, the tasks students engage in could affect the types of sensemaking they use (Li & Schoenfeld, 2019). The effect of different tasks on students' use of mathematical sensemaking is underexplored. **RQs:** How do different tasks on mathematical equations in biology affect the types of mathematical sensemaking, and connections between types, discussed by students?

Incoming biology majors at a large R1 university participated in a session on mathematical modeling of population growth as part of a summer orientation program. Pairs of students were recorded as they engaged in a sequence of two mathematical tasks. The first task varied in different sessions, but the second task was always the same, modifying an equation from the first task. The first task was one of the following: DM) developing a mathematical equation, CM) comparing two mathematical equations, MR) describing relationships between variables in an equation, and PS) solving problems after being shown how to do so. Four to six recorded discussions for each task were coded by two independent coders for types of mathematical sensemaking and for connections between mathematical sensemaking types (Krippendorf's alpha= .78, .76). Counts were standardized for number of groups and time on task.

Students who engaged in PS in the first task tended to focus on how to perform the steps in the problem-solving process (Math-procedure sensemaking, 67% of instances) compared to students in the other tasks (DM=29%, CM=18%, MR=44%). Students in DM and CM tasks tended to focus on equation structure (Math-structure sensemaking, DM=57%, CM=62% vs. MR=17% and PS=6%). For all groups, the second Modify tasks were more similar in their sensemaking with frequency of Math-procedure sensemaking for all tasks ranging from 23% for CM to 40% for PS, and Math-structure frequency ranging from 37% for PS to 57% for CM.

Connections between mathematical sensemaking types may enhance student problem solving and understanding (Li & Schoenfeld, 2019). Across the first tasks, connections were low, ranging from 4 to 7 average instances per group. For the second task, Modify after CM averaged only 3 instances of connections per group while the other Modify tasks averaged from 12 (after PS) to 19 instances (after MR). Across the Modify DM and CM tasks, group discussion focused on connections between Math-procedure and Math-structure sensemaking and Math-structure and Math-relation sensemaking (relationships between variables). However, for Modify MR and PS tasks, these connections occurred less often and connections between Math-procedure and Math-relation occurred frequently (49%, 66% of connections respectively).

Results suggest an impact of task on type of sensemaking that students discuss and the connections they make, suggesting that for research and instruction, it is important to align task with intended objective. Qualitative analysis is underway to provide an explanation for observed differences in patterns by determining how students are using sensemaking in the tasks.

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