Student Perspectives on Effective Recitation Design in an Active Learning Calculus I Course

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Active learning has become a central approach to student-centered learning in undergraduate mathematics courses (CBMS, 2016; Rasmussen et al., 2019) and has been shown to improve student engagement and outcomes (Altindis et al., 2025; Kurepa et al., 2019). While research on instructor practices in active learning environments is growing, less is known about how students experience these classrooms. This study addresses this gap by examining students' perceptions of an active-learning model implemented in Calculus I recitations at a medium-sized university. Recitations were taught by Graduate Teaching Assistants (TA) and aided by Undergraduate Learning Assistants (LA).

To capture students' experiences, we analyzed responses to two open-ended questions on an end-of-semester survey: *If you were an instructor or a TA designing recitation: (1) What are at least two things you would keep? Explain why these are strengths. (2) What are at least two things you would alter or remove? Explain why those changes would be an improvement.* Data were collected during Fall 2023 and Spring 2024, with 238 students (of a total of 404 enrolled) completing both prompts. Using inductive qualitative thematic analysis and the constant comparative method (Patton, 2002; Strauss & Corbin, 1998), the authors collaboratively developed and refined a codebook with 23 distinct themes organized into five overarching categories: *Student Work Structures & Group Dynamics*, *Instructional Practices*, *Recitation Environment*, *Assignment-Related Aspects* and *Assessment & Review.* Interrater reliability was established through independent coding and reconciliation discussions.

Overall, students mentioned more aspects to *keep* in recitation (429 total codes; ~2 per student) than to *alter or remove* (240 codes; ~1 per student), indicating generally positive perceptions of the active-learning format. The most frequent "keep" themes involved *Instructional Practices* (42.7% of codes) and *Student Work Structures & Group Dynamics* (30.8% of codes). Within these themes, specific strengths were noted by students, with percentages reflecting the proportion of students who mentioned each: *group work* (~50%), valued for fostering collaboration, comfort, and peer explanation; *worksheets* (27%); *teacher-led problem solving* (18%); *introductions* (18%); and *conclusions or wrap-ups* (16%). In contrast, for the "alter/remove" question, *Assignment-Related* themes were most common (31.7% of codes), though most suggestions focused on refinements rather than removals (full removal accounted for 11% of codes). Common refinements mentioned by students included revising *worksheets* to clarify instructions and adjust length or difficulty (21% of students) and improving *group work* implementation, such as having clearer facilitation roles (13% of students).

This study reinforces that collaborative active-learning structures support student engagement (Kurepa et al., 2019; Nji & Chinyelogo, 2025) and adds insight into *how* students want these structures implemented. A novel contribution of this study is eliciting student feedback from the perspective of a TA/instructor, yielding actionable recommendations for strengthening recitations, such as worksheet design and group work facilitation. Incorporating student feedback into active-learning recitation design has the potential to improve the effectiveness of active learning implemented in introductory mathematics courses.

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