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Mary Ann Nelson* (mnelso15@gmu.edu), George Mason University, 4400 University Drive, Mail Stop 3F2, Fairfax, VA 22030. *Improving Understanding, Grades and Retention: Oral Reviews.*

Calculus is often considered the gatekeeper to STEM majors. Unfortunately, nationally about 40% of Calculus I students fail. This paper will report on a study designed to improve students' pass rates, understanding and retention in calculus. The study was framed in a constructivist view of learning with formative oral reviews as the primary intervention. Voluntary, ungraded orals took place prior to each written exam in groups of about five students. Emphasis was on multiple representations, multiple solution strategies, sense-making, mathematical connections and mathematical discourse. Data was collected for four years for fall Calculus I and spring Calculus II students. In at least five of the six unit exams each year, students participating in orals did significantly better (6-20% better on average) than the non-participants, and participants' final course grades averaged .6 to 1 letter grade higher. These improvements were seen across all ability groups. We will present measures of motivation that show that motivation alone does not account for students' dramatic improvements, and present data that demonstrates an average drop in Calculus I failure rates from 31 to 23%, and Calculus II drops from 26 to 20%. Orals have now been piloted by five other Universities. (Received August 29, 2012)