Over the past 10 years, the Department of Statistics at Western Michigan University has developed a question generating system that can be used for creating multiple forms of exams, quizzes and homework for online and face-to-face use. This system can also be used to provide students with a form of instantaneous feedback. With the goal of analyzing how different levels of feedback in an online learning environment impacts students’ performance on assignments, this study presents data collected on two semesters of students enrolled in three different meeting types (strictly online, typical face-to-face, and honors face-to-face) of an introductory Statistics course. The study discusses appropriate methods available to analyze these complex data as well as issues related to computing. In general, this study found the highest level interaction to be significant, suggesting that students in various meeting types learn from feedback differently for assorted quizzes.

Additionally, in factorial analyses, there are sometimes situations where there is an anticipated direction in which the treatment levels differ. Consider, for example, students’ scores on an assessment. A researcher might anticipate that students in an honors section of the course will perform better than students in a non-honors section.
Furthermore, one might expect that post-assessment scores would be higher than pre-assessment scores. There are statistical tests that can provide more powerful results than those tests that do not take this *a-priori* information into consideration.

For a crossed factorial design, the lattice-ordered test is a method used for testing for an overall increase across all factor-levels. For this study, I extended this method to a weighted version that, for certain instances, outperforms the unweighted version. I also developed a novel method for nested factorial designs that test for an overall increase among all nested factor-levels. Within this context, I determined the exact distribution, the exact conditional distribution that adjusts for ties, and the asymptotic distribution. I found that this method has stable Type I error rates and outperforms a parametric version of the test for heavy tailed error distributions. Type I error rates and power estimates were computed via simulation studies for both crossed and nested designs.