Student misconceptions have been studied for decades from a curricular/instructional perspective and from the assessment/test level perspective. Numerous misconception assessment tools have been developed in order to measure students’ misconceptions relative to the correct content. Often, these tools are used to make a variety of educational decisions including students’ achievement level, instructional method effectiveness, and curriculum related achievement progress. These tools have included qualitative and quantitative assessment methods.

The quantitative analysis of misconceptions has mostly relied on classical test theory methods of test construction related to total raw score, percentage of correct responses, and/or percentage of misconception responses. More recently, researchers have begun to use modern test theory methods of test construction including item response theory and cognitive
diagnostic models to assess misconceptions. However, to date, there has not been any test construction modeling that has scaled a student’s ability estimate and a student’s misconception level into a continuous metric.

The purpose of this study was to investigate if it is possible to model misconceptions as single or multiple factor continuous latent variables in addition to a latent variable of interest, and see if modeling misconceptions help provide additional test information. Markov chain Monte Carlo (MCMC) methods were used to estimate model parameters. This study investigated if test length, number of misconceptions, and the prior distribution specification affected model convergence, parameter estimation precision, and the value added impact gained by the modeling of student misconceptions.

The results indicated that knowledge misconceptions can be modeled as a continuous latent trait together with targeted (correct) latent trait. Overall estimation precision was satisfactory for both item and person parameters when single factor misconception was used however increasing the number of misconceptions reduces estimation precision. Increasing the number of distractors measuring misconceptions increases the test information related to the misconception. Moreover, future research might consider test lengths other than 25 or 50 as well as different sizes of sample used in this study. The framework provided by this study could inform and guide the misconception instrument development processes.