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Exploring the FCI using Multi-dimensional Item Response Theory JOHN STEWART, CABOT ZABRISKIE, SETH DEVORE, West Virginia University — Despite its wide adoption and use over the past 25 years, the factor structure of the Force Concept Inventory (FCI) remains an active topic of research. Techniques such as exploratory factor analysis (EFA) have hinted that a multi-dimensional structure may exist, but published structures have not been reproduced. Exploratory factor analysis using multi-dimensional Item Response Theory (MIRT) was used to identify a factor structure different from previously published studies. Correlation analysis showed much of the identified structure could be accounted for by correlations resulting from blocked questions, repeated questions types, and correlations through the total score on the instrument. Using the solutions of faculty and graduate students, we developed a theoretical model of the knowledge structure of the FCI. This model was then refined using MIRT. The refined model was shown to be significantly better than the original model proposed by the developers of the FCI.

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