Dear Internship Committee members,

It is with great interest that I submit this letter as an application for the 2017 psychometrics summer internship position, as posted on your company’s website. I’m currently a PhD candidate in my fourth year in Industrial-organizational psychology at the University of Illinois. With more than 3 years of research experience and education in psychometrics, especially in item response theory (IRT), structural equation modeling (SEM), and factor analysis (FA), I believe I would be an ideal candidate for this position.

I’m competent with IRT-related analyses. During my second year in graduate school, I took a class on IRT taught by Professor Hua-hua Chang, where I learned a lot about item calibration with dichotomous and polytomous IRT models, quality control, scaling and linking, item bias, and differential item functioning (DIF), and did several assignments on these topics.

Under the instruction of my advisor Professor Fritz Drasgow, I did my Master’s thesis on IRT, too. I compared the performance of the Samejima’s Graded Response Model (SGR), and the Generalized Graded Unfolding Model (GGUM) in analyzing DIF of a Well-being scale and a Curiosity scale, using data collected from the U.S. and China. Although the computation of DIF under the GGUM failed due to the ill-conditioned matrices computed in GGUM2004 via the marginal maximum likelihood (MML) technique, we found that under the GGUM, both scales actually exhibited less Differential Testing Functioning (DTF) than under SGR. This finding along with the fact that in our study the GGUM in general had better fit than the SGR, indicate that the GGUM may be useful in DIF detection, as long as we can figure out a better technique than MML to obtain accurate item parameter estimates.

Thanks to this project, now I am proficient in using MULTILOG, GGUM2004, flexMIRT, and MCMC GGUM for item calibration, and in R programing for a variety of IRT analyses, including running packages (e.g., “lordif”, “difR”) for DIF computation, data generation with different IRT models, writing functions that automatically generate syntax for MULTILOG and GGUM2004, and calling from R external IRT programs to run automated analyses such as the constrained baseline and the free baseline modeling. I also had a lot of practice with MODFIT, a widely used Excel macro for computing the fit for IRT models, and I am able to quickly get model fit computed from it and give accurate interpretation of the results for various IRT models (e.g., 2PL, 3PL, SGR, GGUM…). I have the ability to evaluate item features and qualities based on the ICCs, as in the course of working on my thesis, I saw and interpreted over a hundred of them, for the purpose of recognizing non-discriminating items, unfolding items, and negative items.

In addition to DIF, I have the ability to analyze measurement equivalence (ME) also via the confirmatory factor analysis (CFA) approach. In a project that I just finished with Professor Brent Roberts, the PISA 2012 data was used to investigate the prediction of math achievement and truancy by perseverance, controlling for SES and gender, across 9 major cultural groups consisting of 68 participating countries and regions. It was found that perseverance, especially the negative factor (including items such as giving up easily, and putting off difficult problems) of it, was a great predictor of low math achievement and high truancy, and this relationship held across all 9 cultural groups.

This project has given me the opportunity to get skilled in using CFA in both Mplus and AMOS to examine ME, and performing in these programs multigroup SEM to study the relationship between the response and predictor variables. Before conducting SEM, to figure out the proper structure of the measurement model, I carried out in SPSS data splitting and merging, random sampling, and exploratory factor analysis (EFA).

I also gained experience in factor analysis (FA) through a number of statistics course, where I worked on FA assignments in both R and SAS. Moreover, I performed FA in SPSS on a Conscientiousness scale development project, supervised by Professor Brent Roberts. I was responsible for factor analyzing the data collected for our item pool of more than 300 items, in order to figure out the structure and dimensionality of the data. I carried out both EFA and CFA, with different types of extraction methods and rotations, and I’m adept at interpreting sample adequacy, eigenvalues, the scree plot, factor loadings, and factor correlations to decide the optimal number of factors, proper factor names, and which items to drop from further analyses.

I’m passionate about assessments analyses, including but not limited to item calibration, modeling and scoring of responses, and measurement equivalence, which in my opinion, are important aspects that need to be further explored of the development of a good assessment, which is the key to more effective admission, raining, and hiring processes, more accurate prediction of a variety of education-related outcomes, and could be of great help for schools and policy makers. I’m confident that my research experience, skills, education, and strong interests in psychometrics have prepared me to be a strong intern for your company. I look forward to further discussing my qualifications with you. Thank you for your time and consideration.

Sincerely,

Luyao Zhang