Matthew Robert Reynolds, Ph.D.
Psychology and Research in Education
Joseph R. Pearson Hall
1122 West Campus Road, Room 641
Lawrence, KS 66045-3101
The University of Kansas
Phone: (785) 864-9712
email: mreynolds@ku.edu

Personal Research Agenda

My research agenda for the next three to five years will follow two major strands. The first strand concerns the measurement and psychometric structure of intelligence. The second strand is longitudinal modeling of developmental psychopathology. Here, I will talk about where my research in intelligence will go for the next few years.

My interest in intelligence focuses on understanding what ability constructs intelligence tests measure, and then how to use model-based techniques to reveal whether these constructs are consistent across different groups. I have been involved in research evaluating the factor structure of individually administered intelligence tests for children, including the WISC-IV and the KABC-II. I am continuing this line of research with other intelligence and neuropsychological measures using the norming data from three different popular measures. At the initial stage of the research, the focus is on understanding what constructs are measured via confirmatory factor analysis. Once the factor structure is determined, the research turns to understanding how these cognitive abilities are measured across age, sex, and the distribution of general cognitive ability. This research has a practical influence because it may influence how school psychologists interpret intelligence test scores.

Testing whether the same constructs are measured across the entire general cognitive ability distribution, and whether or not the relative importance of these factors changes at different points along the distribution, is also tied into a more theoretical line of research. This research sets out to answer the question: Are the cognitive ability factors equally important in explainin*g* individual differences across different levels of cognitive ability? Findings from my previous research, as well as those from others, have

demonstrated that the importance of the general cognitive ability, *g*, decreases in importance relative to other cognitive abilities as the level of general ability increases. I have two standardization samples from popular intelligence tests, one an adult population, and one a child population, that I am using to answer that question. In particular, I am investigating what types of model-based methods are most useful to investigate this phenomenon.

Although the research is important in that any theory of intelligence must account for this phenomenon, it also has practical implications. The psychological definition of a learning disability states that there is a disorder of a basic psychological process. If general intelligence has less influence on explaining individual differences in performance on specific cognitive tests, then this is consistent with the definition of learning disability as an unexpected underachievement in learning based on general ability, but an expected difficulty in basic skill acquisition due a disorder of a basic psychological process. These findings could influence the practice of evaluating for a specific learning disability. That is, the procedure would be to obtain an estimate of general cognitive ability using testing that load highly on the general factor, then using more specific cognitive tests (e.g. processing speed, short-term memory) to determine whether there is a weakness in one of the more basic psychological processes, in conjunction with a deficit in a basic achievement skill.

Abstract

Understanding the cognitive abilities measured across different intelligence tests is important for evaluating the validity of classification of such abilities within intelligence test batteries. Two hundred children, ages 10 to 12, were administered subtests from the Woodcock-Johnson Tests of Cognitive Abilities—III (Woodcock, McGrew, & Mather, 2001), Wechsler Intelligence Scale for Children—IV (Wechsler, 2003), Kaufman Assessment Battery for Children—II (Kaufman & Kaufman, 2007), and the NEPSY—II (Korkman, Kirk, & Kemp, 2007). A planned missingness design allowed for a broad coverage of subtests to be administered to children. Inter-battery, confirmatory factor analyses were performed to test whether the broad and narrow ability constructs measured by these tests are consistent with Cattell-Horn-Carroll theory. Additional models were estimated to investigate for potential intermediate factors between the broad ability factors and the general factor. Moreover, multiple-group, mean and covariance structure analysis and factor mixture models were performed to investigate whether the importance of the broad and general abilities factors changed at different levels of the general factor.

Proposal

My research agenda will focus on understanding what is measured by intelligence tests and whether the factors explain individual differences equally well across the ability distribution. One goal is to collect data on individuals who are tested with more than one intellectual test battery. These data would provide an opportunity to investigate what is measured by intelligence tests without having to be constrained by the specific tests in a particular battery. Specifically, interbattery factor analyses could be performed. The information gleaned from this research would provide insight about the various broad cognitive abilities measured across different cognitive and neuropsychological tests. The research would serve to support or not support practices such as cross-battery assessment of cognitive abilities. These data, from multiple subtests, would also be ideal in studying whether the factors perform equally well at explaining individual differences in test scores across the ability distribution.

The multi-site collaboration research could focus on answering the question: What broad abilities are measured by various psychological tests? A multi-site collaboration would be ideal because to answer this question, data would need to be collected on at least 200 individuals. Given new methods in model estimation involving missing data, the data collection procedures would be designed to include planned missingness. Therefore, across the various sites an a priori plan of test administration could be used to maximize the efficiency of data collection procedures. This design would allow for a greater number of subtests to be administered to individuals while minimizing the actual time of test administration.

The research could be accomplished with a budget of less than 5,000 dollars given University training have access to a variety of intellectual and neuropsychological measures. Hiring and paying individuals who are qualified in standardized test administration would be the largest cost. A minimum of 200 participants would be the goal. Because the research would be focused on school age children, ideally the participants would range in age from 10-12. The participants would be tested in local elementary schools, coming from the general education curriculum. Planned missingness would be used so that various tests from the Woodcock-Johnson Tests of Cognitive Abilities—III (Woodcock, McGrew, & Mather, 2001), Wechsler Intelligence Scale for Children—IV (Wechsler, 2003) , Kaufman Assessment Battery for Children—II (Kaufman & Kaufman, 2007), and the NEPSY—II (Korkman, Kirk, & Kemp, 2007) could be administered strategically.

An obvious advantage of multi-site data collection is that more researchers at different sites could collect more data. In addition, the multi-site collaboration would also reduce effects such as selection bias or clustering which may occur if all data were collected from one area. The possible disadvantage would be coordination across the sites, but this should not be a problem with the current proposal. All of the analyses could be performed at one site, on-going communication of the results via email and phone pose no problems.

Inter-battery confirmatory factor analyses would be performed to test whether the broad ability factors measured by these tests are consistent with the Cattell-Horn-Carroll broad ability factors. Moreover, given the coverage of tests, potential intermediate factors between the broad abilities and the general factor will be investigated. Last, in order to

test for whether the general factor becomes less important at higher levels of general ability, both multiple group mean and covariance structure (analysis MG-MACS) and factor mixture models will be estimated. In the MG-MACS models, it is expected that the explanatory value of the general factor will be less in a higher general ability group. In the factor mixture models, it is expected for more than one latent class, with identical factor structures, to emerge. One group would be characterized by lower general ability scores, the other group, or groups, would be characterized by higher general ability scores, with a lower general factor variance and higher standardized subtest residual variances.

References

Kaufman, A. S., & Kaufman, N. S. (2007). *The Kaufman Assessment Battery for Children--Second Edition*. Circle Pines, MN: American Guidance Service.

Korkman, M., Kirk, U., & Kemp, S. (2007). *NEPSY--II*. San Antonio, TX: PsychCorp.

Wechsler, D. (2003). *The Wechsler Intelligence Scale for Children--Fourth edition.* San Antonio, TX: PsychCorp.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson Tests of Cognitive Abilities*. Itasca-IL: Riverside.