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THE CONCURRENT VALIDITY OF THE LEARNING COMPONENT OF THE MISSOURI ABILITY SCALE

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THE CONCURRENT VALIDITY OF THE LEARNING COMPONENT OF THE MISSOURI ABILITY SCALE

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ABSTRACT

The present study was designed to determine the concurrent validity of the Missouri Ability Scale (MAS), a new measure of independent functioning and learning currently in development. The MAS consists of 10 subtests and is designed to be administered to the examinee and an informant. Fifty individuals (M = 13.1 years; SD = 5.8 years) were administered the MAS and a cognitive abilities test (i.e. WISC-V, KABC-II, WJ-IV). Overall, the Spearman correlations between the MAS learning component and the measures of intellectual ability were moderate-to-strong, indicating good validity. Consistent with the hypotheses, the MAS learning component and the Cattel-Horn-Carroll (CHC) intelligence factors shared significant variance. The implications and limitations are discussed.

CHAPTER ONE: INTRODUCTION

Intelligence and Adaptive Functioning

Intellectual functioning and adaptive functioning are crucial components in understanding human behavior and potential. Intellectual functioning has many assorted definitions that attempt to quantify intelligence. These theories aim to define intelligence based on its predictive use in determining learning ability throughout the lifespan. Generally, these theories attempt to operationalize intelligence as involving abstract reasoning, problem-solving ability, and capacity to acquire knowledge (Sattler, 2008). Historically, intelligence tests have been used in professional settings for job application, military settings for recruitment and placement, clinical settings for diagnosis and treatment, and academic settings for planning and intervention (Sattler, 2008; Terman, 1916).

Adaptive functioning is the ability to adjust to one's environment and perform functional, independent behaviors to complete goals in daily life (American Association on Mental Retardation, 2002). Adaptive behavior tests are used mainly in clinical and academic settings such as hospitals, schools, and residential communities. Like intelligence, adaptive behavior level is used to inform diagnostic and treatment planning. Importantly, these two constructs are used in conjunction. Specifically, through diagnosis of developmental disabilities and the determination of the receipt of government services (American Psychiatric Association, 2013; The Home and Community Based Settings Rule, 2015).

Research shows that intelligence tests and adaptive tests overlap in purpose and application (Hayes & Farnill, 2003; Kenworthy, Case, Harms, Martin, & Wallace, 2009). Both constructs are correlated to some extent. General intelligence (*g*) demonstrates predictive validity of adaptive functioning, showing strongest correlations with conceptual and practical skills, while showing the weakest correlation with social skills (Murray, McKenzie, & Murray, 2014). However, this does not imply that there is a causative effect between the two. In fact, there have been “no published studies supporting the notion of a causal link between intelligence and adaptive behavior” (Tasse, Luckasson, & Schalock, 2016, p. 387).

Tasse, Luckasson, and Schalock (2016) explained that, while research has frequently shown a correlation between these two constructs, it would be nearly impossible to show causation between them, though both constructs should be given joint consideration when diagnosing intellectual disability. Harrison (1987) reported minimal-to-strong correlations, ranging from .03 to .91, between adaptive behavior and intelligence across a multitude of measures, with the majority of measures showing only moderate correlation.

Generally, adaptive behavior and intelligence have a curvilinear relationship (Alexander, 2017). IQ has been shown to account for 28% of variance among adaptive functioning level, showing stronger correlations with low-to-moderate IQ than with above average or profoundly deficit IQ levels (Alexander, 2017). For special populations, such as individuals with Autism Spectrum Disorder (ASD), adaptive behavior and intelligence show minimal correlation, with adaptive behavior deficits existing across severity of disorder and presence of language impairment (Matthews et al., 2015; Mouga, Almeida, Café, Duque, & Oliveira, 2015). Therefore, when designing an assessment that looks at both, adaptive and intellectual functioning, one should keep in mind that while the constructs are related they are not causative.

Test Development

When tests are designed, they must demonstrate that they are reliable and valid. Measures should be able to produce equivalent results across time, setting, raters, and participants (Sattler, 2008). Furthermore, measures should accurately evaluate what they are designed to evaluate. These concepts are measured through reliability and validity (Price, 2015).

Reliability, or consistency, is a measure of how well a test produces consistent results. That is, reliable measures are those measures that, "produce consistent scores that are not subject to chance fluctuations" (Spatz, 2011, p. 104). It would be psychometrically unsound to give an assessment that is unreliable. If multiple repetitions of an assessment are given that are meant to produce relatively stable results (such as a cognitive ability score), poor measurement reliability can lead to inaccurate results and increased measurement error.

Validity can be thought of as the usefulness of an instrument and helps determine, "whether an instrument actually measures what it sets out the measure" (Field, 2013, p. 12). To measure cognition or adaptive behavior, an assessment should be developed targeting those constructs. Validity is determined in multiple ways. These include criterion validity (encompassing concurrent validity and predictive validity) and content validity. Criterion validity measures an assessment through comparison of a predetermined criteria by evaluating how a measure relates to other well-established measures (i.e., concurrent validity) and how well a measure predicts outcomes across time (i.e., predictive validity), while content validity is an intra-test measure assessing how well test items represent the construct of interest (Field, 2013).

Concurrent validity is important in that it allows researchers to build from previous empirical data and capitalize on established instruments through comparison. This can save effort when creating a new measure aiming to garner strength from previous instruments while seeking to overcome their limitations. Concurrent validity is a fast and affordable way to measure validity in an assessment.

Purpose of the Study

The purpose of this study was to examine concurrent validity of the Missouri Ability Scale (MAS) by comparing it to current cognitive measures. Cognitive measures included the Cognitive measures included the Woodcock-Johnson IV: Tests of Cognitive Abilities (WJ-IV), published in 2014 (Shrank, McGrew, & Mather), the Kaufman Assessment Battery for Children, Second Edition (KABC-II), published in 2004 (Kaufman & Kaufman), and the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V), published in 2014 (Wechsler). The MAS is designed for use with individuals from early childhood through late adulthood but is still in development. Content validity has been established through expert application, modification, and feedback. The normative sample has been obtained as well, and a number of other concurrent validity studies have been completed. Additional reliability and validity studies are in process.

Terms and Definitions

- Adaptive Behavior/Functioning: The “collection of conceptual, social, and practical skills that all people learn to function in their daily lives”, as measured through assessment via standardized testing or other empirically-valid means (American Association of Intellectual and Developmental Disorders, 2018).

- Cognitive Functioning Level/Intelligence: Mental processes and faculties used in problem-solving, abstract reasoning, and knowledge acquisition as measured by standardized assessments. These processes are measured and founded in one or more empirically-supported intelligence theories (e.g., Cattel-Horn-Carrol) and produce an objective, measurable quantity called an intelligence quotient.
- MAS: The Missouri Ability Scale. A norm-referenced assessment of adaptive functioning designed for use with ages one to adulthood. The MAS was created to measure all aspects of adaptive behavior required under federal statute in accordance with eligibility procedures for services provided with state and federal support. Of these aspects, learning is often absent from adaptive measures. The MAS is administered via two stages, learning and observation, and includes domains assessing memory, reading, math, communication, motor skills, self-care, self-direction, and economic self-sufficiency.
- WISC-V: The Wechsler Intelligence Scales for Children, Fifth Edition (Wechsler, 2014). The WISC-V is a comprehensive and individually administered evaluation used for assessing intelligence in children age six to age 16 and 11 months. It is composed of various indices measuring constructs of intelligence (e.g. verbal reasoning, visual reasoning, working memory, etc.) that are used to produce a composite score or Full Scale IQ. The Full Scale IQ is a valid measure for predicting academic achievement and learning.
- KABC-II: The Kaufman Assessment Battery for Children, Second Edition (Kaufman & Kaufman, 2004). The KABC-II is a cognitive measure for assessing processing and

cognitive abilities in children and adolescents from age three to age 18 and 11 months. It is individually administered and uses theory-driven assessment to produce a Fluid/Crystallized Index (FCI) Score or a Mental Processing Index (MPI) Score that are comparable to traditional IQ scores.

- WJ-IV: The Woodcock-Johnson IV: Tests of Cognitive Abilities, is an individually administered intelligence scale designed for individuals age two to over age 90 (Shrank, McGrew, & Mather, 2014). It is theoretically founded in Cattel-Horn-Carrol theory and measures both broad and narrow range cognitive abilities. The WJ-IV uses individual assessments and indices in combination to produce a General Intellectual Ability (GIA) Score and Gf-Gc Composite, both of which are comparable to traditional IQ scores.
- 42 C.F.R. § 425.9 C.S.R. 45-2.010 Eligibility for Services From the Division of Developmental Disabilities: The law that led to the conception and creation of the Missouri Ability Scale. The Division of Developmental Disabilities set forth procedures to assist practitioners when determining service eligibility for individuals with intellectual disability. Briefly, the law established regulations to support applicants throughout the eligibility process, and to help professionals use appropriate and effective evaluation methods when determining level of service needed for those applicants. Furthermore, the law aimed to reduce barriers to evaluation and encourage accountability between state, county, and local agencies when providing services to individuals with developmental disabilities.
- Intellectual Disability/Mental Retardation: The Diagnostic and Statistical Manual for

Mental Disorders (American Psychiatric Association, 2013) defines intellectual disability as, “A disorder with onset during the developmental period that includes both intellectual and adaptive functioning deficits in conceptual, social, and practical domains. The Individuals with Disabilities Education Act (2004) defines intellectual disability as, “significantly subaverage general intellectual functioning, existing concurrently with deficits in adaptive behavior and manifested during the developmental period, that adversely affects a child’s educational performance”.

CHAPTER TWO: REVIEW OF LITERATURE

Two constructs perpetually linked in psychology include intelligence and adaptive behavior. Both constructs are used for a variety of diagnostic and classification purposes and have a detailed history related to cultural and legal evolution (Price, Morris, & Costello, 2018; Stough, 2015). Researchers and clinicians practicing across therapeutic, educational, or vocational settings should have a detailed understanding of these constructs. Essentially, it is important to understand their history, application, relation, and distinction.

Cognitive Ability/Intelligence

First, one of the most commonly used measures in applied psychology, such as clinical and school psychology, is the cognitive test. In fact, school psychology practitioners across the U.S. reported using a cognitive theoretical framework daily, frequently relying on multiple cognitive assessments in their evaluations (Sotelo-Dynega & Dixon, 2014). Cognitive functioning, also called “intellectual functioning”, has a long and detailed history in psychology with multiple individuals having sought to describe, measure, quantify, and predict the nature of intelligence. As a result, various definitions have been created to explain precisely what is meant by cognitive functioning.

Today several definitions exist to that seek to explain what cognition is and what it measures. One of the earliest researchers to attempt to measure cognition was Sir Francis Galton. Galton (1869) mainly examined intelligence and its relation to heredity; his research into family traits and the study of twins led him to conclude that intellectual functioning was primarily the result of heritable traits. James Cattel (1890) continued to explore the measurement of intelligence and pioneered early forms of mental measurement. Cattel was interested in examining how individuals performed on these tests compared to the performance of the given population at large (i.e. normative comparison). By doing so, he hoped to offer insight into how a person's potential might predict their future success as a student or employee in the business world.

Likewise, Alfred Binet and Theodore Simon brought their passion for cognition to applied psychology in the late 19th century. Binet was interested in understanding how intelligence could be measured to understand the development of the individual and their future likelihood for success, and defined intelligence as, “judgment, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances (Binet, 1916).

Other definitions of cognitive function have varied, but share core meanings revolving around adjusting and adapting to problems within the environment. For example, William Stern (1914) viewed intelligence as the capacity of an individual to adapt their thinking and adjust to new problems encountered in life. Inspired by Binet's work with children, he sought to devise a single number to quantify intelligence. This number, the total of a person's calculated mental age divided by their chronological age and multiplied by 100, was dubbed the “intelligence quotient” (IQ).

Jean Piaget (1950) defined intelligence as the continued assimilation and accommodation of data, or the ability to maintain or change cognitive processes to adapt to new information. David Wechsler (1958) categorized intelligence as, “A global concept that involves an individual’s ability to act purposefully, think rationally, and deal effectively with the environment” (p. 7). Howard Gardner (1993) described intelligence as the ability to problem-solve and create something of value to a culture or set of cultures. Furthermore, Gardner described not one, but multiple intelligences involving various facets such as language ability (Linguistic Intelligence), musical ability (Musical Intelligence), and visual reasoning (Spatial Intelligence). Regarding cognitive ability, modern definitions based on neuropsychology include Goldstein's (2011) definition as "mental processes such as perception, attention, memory, and so on, that are what the mind does" (p.5). Nolen-Hoeksema (2010) defined cognition broadly as, "thought processes that influence behavior and emotion" (p.19).

The previously discussed definitions of intelligence are primarily theoretical models. Various empirical models of intelligence have spawned from these definitions, leading to applied assessment. Of these models, John Carrol's three-stratum theory of intelligence from which Cattel-Horn-Carrol (CHC) theory derives has empirical support (Sattler, 2008).

Two assessment theories popular today are the PASS model and Cattel-Horn-Carrol theory. The "PASS" model is based on the neuropsychological work of Alexander Luria and principled by Jack Naglieri through the Cognitive Assessment System (CAS) (Naglieri & Das, 1997). The PASS model (P: Planning, A: Attention, S: Simultaneous, S: Successive) views the brain as operating in three functional units; the first deals with regulation of attention, the second with storage, processing, and retrieval of simultaneous and successive information, and the third with direct programming of mental activity or planning (Das, Naglieri, & Kirby, 1994). Naglieri designed the CAS as a direct measure of cognition based on the PASS model to help identify interventions that link cognition to academic achievement. Though it is not without its critics, the CAS has shown satisfactory construct validity and correlates with achievement as well as other cognitive measures (Nishanimut & Padakannaya, 2014).

CHC theory is the current model used as a foundation in most modern cognitive assessments. CHC theory proposes that intelligence is composed of multiple stratum. Specifically, it states that intelligence is composed of an overarching general ability (*g*), eight broad abilities (visual reasoning, fluid reasoning, verbal reasoning, etc.), and more than 70 narrow abilities (induction, sequential reasoning, memory span, perceptual speed, etc.; Carrol, 1993). Since 2000, nearly all cognitive assessments, with the exception of the Wechsler scales, have based their implementation on CHC theory, indicating that present and future cognitive assessment will likely continue to rely on CHC theory as an influence (Flanagan, Ortiz, Alfonso, & Dynda, 2008).

As for assessments themselves, cognitive measures have undergone complex progression since their conception. In the emerging years of intellectual assessment, Binet and Simon collaborated to form the Binet-Simon scale, designed to measure the ability of a child to perform tasks relative to their same-aged peers (Binet, 1916). Binet stipulated that children who performed tasks typical of older-aged children would be considered to have higher mental functioning, while those who were unable to perform tasks typical of their age would be considered to have lower mental functioning. Sample tasks used on his assessment included copying pictures, distinguishing from left and right, using given words in a sentence, recalling digits, and so on. Terman would eventually standardize Binet's scale to the larger American population (Fancher & Rutherford, 2016). During his tenure at Stanford University, Terman would modify the Binet-Simon scale into a more sophisticated measure of cognition, later named the Stanford-Binet.

In 1917 and 1918, the Army Alpha and Army Beta tests were released. These tests were designed to place World War I army recruits for military position based on level of intelligence and were precursors to modern intelligence tests (Thompson, 2007). The Army Alpha was a verbal-based test that examined recruits' ability to follow directions, understand quantities, process information, and so on, while the Army Beta was its non-verbal counterpart designed for illiterate or limited English-speaking individuals (Sellman, 2004).

Wechsler (1939), seeing Binet's assessment and focus on children under the age of 15 as limited, created the first intelligence test designed specifically for adults (i.e., ages 16-60) and consisted of ten tests composing a “Full Scale” score. Wechsler became familiar with the Army Alpha and Beta while serving in the military and sought to capitalize on their strengths while overcoming inherint weaknesses in design, as well as in standardization of Binet's scales (Wechsler, 1939). Wechsler's new assessment, called the Bellevue Intelligence Tests, included tests measuring general comprehension, visual reasoning, arithmetical reasoning, memory span, and verbal reasoning, as well as updated norms with approximately 3,000 subjects (p.118).

Today, three of the most commonly used assessments in applied psychology include the Wechsler Intelligence Scales for Children, Fifth Edition (WISC-V), the Kaufman Assessment Battery for Children, Second Edition (KABC-II),) and the Woodcock-Johnson IV: Test of Cognitive Ability (WJ-IV). Cognitive assessment will likely continue to be used extensively in education. Lack of empirical evidence for current models, such as Response-to-Intervention

(RTI), paired with extensive research showing efficacy of cognitive assessment in linking weaknesses and strengths to intervention, ensure that school psychologists will continue being trained in cognitive testing (Decker, Hale, & Flanagan, 2013).

Adaptive Behavior

Next, another frequently used and pertinent construct in psychology is adaptive behavior, or adaptive functioning. Adaptive behaviors are simply that: behaviors needed to adapt. These behaviors allow individuals to access resources in their community, communicate clearly, interact with others effectively, and meet their daily living needs through behaviors such as dressing, brushing teeth, and toileting. Furthermore, individuals function using adaptive behaviors with minimal-to-no prompting or assistance. Adapt means to, “adjust oneself to different conditions, environment, etc.” (Adapt, 2018). Adaptive behaviors are independent behaviors. They allow individuals to adjust their relationship to their environment and to cope with environmental change through functional actions. In other words, an individual uses adaptive behavior for independent needs and to attain goals without external intervention.

According to the American Association of Intellectual and Developmental Disabilities (AAIDD), adaptive behavior is defined as the “collection of conceptual, social, and practical skills that all people learn in order to function in their daily lives” (2018). Here, sample conceptual skills include abilities needed to read, understand money value, comprehend the use of numbers, and interpret time. Sample social skills include behaviors associated with social interaction, social problem solving, situation awareness, responsibility taking, and so on. Lastly, sample practical skills include the ability to use money, take care of one's hygiene, arrange for travel and transportation, and other independent care and occupational skills.

When practitioners consider adaptive behaviors, they likely envision how a person uses those behaviors to accomplish needs in a real-world setting. Adaptive behaviors allow individuals to complete tasks independently in a social context and are aligned with chronological age (American Association on Mental Retardation, 2002). Individuals with developed adaptive functioning can meet their needs under their own volition. They do not require significant external guidance or assistance to complete age-appropriate tasks.

The National Research Council Committee on Disability Determination for Mental Retardation (2002) outlined past development in regards to measure and application of adaptive behavior, previously referred to as social maturity. Here, the Committee reported past measures of adaptive behavior involving calculation of age, coordination, years retained in school, and other nuanced measures such as facial features and expressions. Additionally, early measures of adaptive behavior date back to 1916 and involve, among other things, use of foam board and perceptual speed tasks. Interestingly, in their summary of intelligence and its relation to adaptive functioning, the Committee (2002) reported a lack of consensus among professionals in determining when to consider adaptive behavior deficits when classifying Mental Retardation (currently referred to as Intellectual Disability, or ID). In fact, they prescribed caution in using adaptive assessment cut-off scores (e.g., two standard deviations below mean) when classifying intellectual disability stating, "...a person may be diagnosed as having mental retardation even if the adaptive behavior results do not meet the cutoff criteria if there is compelling evidence of adaptive behavior deficits that significantly impair performance of expected behaviors." (The

National Research Council Committee on Disability Determination for Mental Retardation, 2002, p. 230).

An important development in regards to adaptive behavior assessment occurred during the 1960s-1970s. An influx of individuals into in-patient and community-based assisted living programs created a need for stronger assessments aimed towards identifying strengths and weaknesses of individuals with adaptive deficits and linking those characteristics to effective interventions (Harrison & Raineri, 2008). Similarly, with the 2002 Supreme Court ruling (*Atkins v. Virginia*) that the execution of individuals with Mental Retardation is considered cruel and unusual punishment, it became imperative that valid and reliable standardized measures exist and are updated regularly.

Furthermore, not only should standardized measures be used (e.g., rating scales), but given the high-stakes outcomes related to services and benefits procured by those classified with an intellectual disability, it is important that evaluations draw from a variety of sources when determining functioning. Multiple sources might include rating scales, interviews, observations, or other methods. As stated by Tasse (2009), in regards to using adaptive measures in legal cases, “The use of a standardized adaptive behavior scale is often insufficient to capture all aspects of an individual’s adaptive behavior” (p. 116).

Like cognition, results of adaptive behavior measurements are used in many ways, namely determining eligibility criteria for certain disorders. In schools, under the Individuals with Disabilities Educational Act (IDEA), adaptive behavior levels are used in classifying presence and degree of mental disability (2004). It is also used as data for treatment programming and planning of interventions for students with specialized needs. Comparatively, the DSM-5 uses adaptive functioning level to determine the degree of disability involved with individuals diagnosed with mental disorders such as ID and ASD, with less emphasis on intelligence as was provided in the past. Degree of disability is ranked by severity level and specified as mild, moderate, severe and profound. These specifiers are based on the developmental level, need of support, and ability to attain age-level skills across social, conceptual, and practical domains of adaptive functioning. The DSM-5 notes that deficits in adaptive functioning for ID, “result in failure to meet developmental and sociocultural standards for personal independence and social responsibility” (p. 33).

Adaptive assessment emerged due to the concern with problems and bias in IQ testing and over-identification of minority individuals with intellectual disability. *Larry P. v. Riles* (1979) ruled that IQ tests alone were prohibited for placement of African-American students and aimed to reduce over-representation of minority students with intellectual disability, while *Diana v. State Board of Education* (1970) prohibited testing of non-native English language students with IQ tests that had not been developed in their native language. In *Hobson v. Hansen* (1967), court rulings stated that group-administered tests were not to be used for student placement, nor where tests that were not normed in a student's population to be given. Then, in 1972, the U.S. Court of Appeals, Ninth Circuit ruled that adaptive behavior assessment and parent interviews were required for all intellectual disability evaluations, including informed consent for evaluation and placement (*Guadalupe v. Tempe).* Not until 1980 (*PASE v. Hannon)* and 1995 (*Crawford v. Honig)* did courts rule for the accepted use of IQ tests with minority individuals, as long as such tests were used in conjunction with additional assessments (e.g., adaptive behavior, observation, interviews, and so on).

For individuals with disabilities, adaptive behavior can radically differ from the general population. One important factor determining adaptive functioning for individuals with ASD is executive functioning. Executive functioning (e.g., planning, organizing, shifting attention, etc.) has a mitigating factor on adaptive behavior for this population. Specifically, individuals with weaknesses in inhibition, behavior regulation, attention shifting, and self-monitoring showed significantly reduced adaptive behaviors compared to those without such weaknesses (Pugliese et al., 2016). Furthermore, individuals with ASD showed increasing discrepancies between intelligence and adaptive behavior as they aged, with daily living skills and socialization skills inversely correlated with executive functioning (Pugliese et al., 2015).

Adaptive behavior has definite limitations in regards to its construct and measurement. For example, Tasse and colleagues (2012) identified four key issues in regards to adaptive assessment including inconsistencies in test development theories, problems with rater reliability, using self-report measures versus measures from third-party candidates, and lack of standardization with various forensic contexts (e.g., prison populations, individuals whose living conditions reduce community involvement, and retrospective diagnosis for individuals over age 18). Similarly, the authors reported that, unlike intelligence, adaptive behavior does not tend to follow a normal distribution and measures suffer from lack of items measuring upper ability level (i.e., ceiling effects). In other words, once individuals reach a certain threshold of adaptive ability there is a stopping point where functioning is not drastically different. There are no

“Extremely High” range scores for self-care or communication.

Overall, there are two primary purposes of adaptive assessment. First, adaptive assessment seeks to address programming needs for individuals with disabilities (i.e., identifying strengths and weaknesses). Second, adaptive assessments aim to inform placement and eligibility decisions to set appropriate goals and objectives for individuals with behavior deficits (Hangauer, Worcester, & Armstrong, 2013). When used in conjunction with cognitive assessment, and other measures, adaptive assessments can more aptly inform practice and intervention with the goal of reducing deleterious effects of disability on learning, problem-solving, and adaptation to one's environment.

Test Development

The initial development of any psychological assessment must include extensive examination of its structure and implementation. Pilot studies, normative sampling, factor analysis, and other intricate procedures are conducted to help add to a measure's effectiveness and practicality. The goal of these procedures are to help build a case for an assessment's reliability and validity. These concepts are examined in the proceeding sections.

Reliability. As stated previously, reliable measures are able to produce useful and consistent results across a variety of factors; these include reliability between raters, reliability between administration, reliability within the test itself, and reliability between multiple forms (if used). Inter-rater reliability, or agreement between multiple raters, is an important concept for any frequently used measure. In a study of 84 clinicians from psychiatry, psychology, social work, and their patients, inter-rater reliability for an adaptive behavior measure (the Global

Assessment of Functioning) was significant. Results suggested agreement between therapists and patients when completing adaptive assessments and conducting developmental histories (DeFife, Drill, Nakash, & Westen, 2010). Inter-rater reliability was achieved for the Developmental Behaviour Checklist (DBC) by using 38 pairs of raters, paid carers for individuals with ID in a community home with two raters assessing the same individual that the raters were familiar with (Mohr et al., 2011). The intraclass correlation coefficient (ICC = .69) showed satisfactory inter-rater reliability.

In a study of the Diagnostic Adaptive Behavior Scale (DABS), researchers established test-retest reliability by interviewing 30 participants with a mean age of 14.7 years (SD = 5.7), twice over a period of one month (Tasse, Schalock, Balboni, Spreat, & Navas, 2016). Test-retest reliability (r = .78-.95) for the DABS was good-to-excellent. Test-retest reliability for the MAS has also been good (Lang, 2018).

For the WISC-V, the split-half method was used to determine internal reliability. The average reliability for indices ranged from good-to-excellent (r = .88-.93; Wechsler, 2014). Test-retest reliability was obtained by administering the WISC-V to participants twice over a period of 26 days, on average. Reliability for the Full-Scale IQ was excellent (r^b = .92). Likewise, inter-rater reliability was high (r^b = .98-.99). For the KABC-II, internal reliability for the FCI was excellent (r^b = .96-.97). Similarly, test-retest reliability, given twice on an average of 30 days apart, for the FCI was high (r^b = .90-.94). Overall, reliability studies on normed samples were high for the KABC-II FCI (Kaufman & Kaufman, 2004).

Validity. As mentioned earlier, a test is said to be valid when it measures what it purports to measure. In a review of available adaptive assessment instruments, Tasse and colleagues (2016) identified over 200 measures. As part of their review, conducted per procedures in creating and norming the DABS, Tasse and colleagues identified the following four assessments as having the strongest psychometric properties for identifying intellectual disability: Adaptive Behavior Assessment System, Third Edition (ABAS-3), Adaptive Behavior Scale-School, Second Edition (Abs-S:2), Scales of Independent Behavior-Revised (SIB-R), and the Vineland Adaptive Behavior Scale, Third Edition (Vineland-3). Therefore, when developing a purely adaptive behavior measure it would be recommended to establish concurrent validity an established adaptive assessment that is currently on the market.

Concurrent validity is achieved when two or more assessments measuring similar constructs are significantly correlated with one another. Typically, this would involve using two or more of these assessments on similar, or same, individuals at around the same time, and then analyzing the assessment scores to look for correlations in results. For a measure of expressive language across age groups and gender, the Communication Complexity Scale (CCS) was found to have significant concurrent validity with the Vineland-II Expressive subscales and the Communication Matrix, during initial the study, and the Early Social Communication Scale on the subsequent study (Brady et al., 2018). Regarding the assessment central to the current study, the Missouri Ability Scale has demonstrated concurrent validity with the ABAS-3 in past research (Janecek, 2017).

In other words, items that most strongly measure a target construct should be retained, while weaker items should be eliminated or replaced. In creating the Frequency of Actions and

Thoughts Scale (FATS), developers used a two-tiered method to design a brief measure of adaptive behavior and cognition (Terides et al., 2016). Using a 28-item scale administered to 661 participants, the first tier of implementation allowed the developers to narrow the instrument to 12 items strongly related to the given constructs. The second tier used the 12-item scale in a pre-test post-test method for individuals undergoing cognitive-behavioral treatment. Overall, the FATS was found to have satisfactory construct validity.

Regarding the WISC-V, correlation and concurrent validity was established with the KABC-II, the previous edition of the Wechsler Intelligence scale (i.e. the WISC-IV), and other common clinical measures (Wechsler, 2014). Likewise, the KABC-II correlated well with its previous edition (i.e., the KABC) and other common cognitive measures (Kaufman & Kaufman, 2004). The WJ-IV also showed strong concurrent validity with the KABC-II, the WISC-IV, and other cognitive assessments (McGrew, LaForte, & Schrank, 2014). Overall, these three cognitive measures have strong concurrent validity and have been validated through repeated use, experimentation, and expert review.

The Missouri Adaptive Scale (MAS)

The following section on the MAS was obtained from the author (Dunham, 2018). The MAS is a norm-referenced, paper-and-pencil administered measure of adaptive functioning for ages one to adulthood. On this test, adaptive functioning is assessed using both informant input and examinee interactions to gain a more reliable and valid assessment of the individual's daily living skills. It was specifically developed to measure all aspects of adaptive behavior required under federal statute and to provide a single measure of adaptive behavior that could be easily administered and interpreted by most practitioners working for states who are responsible for determining which applicants for state and federal support are eligible for services. The MAS differs from other measures of adaptive behavior in three important ways. First, part of the test requires the examiner to interact with the examinee one-on-one in order to measure visual memory, verbal memory, reading skills, and math skills, and to gauge the client's understanding of a range of independent functioning skills, including judgment. Second, the MAS provides an index of reliability. This helps judge the extent that the informant may be exaggerating or otherwise misrepresenting the client's functioning levels, an issue described by Harrison and Raineri (2008). Lastly, the MAS includes an index of learning that is required under federal statute.

The MAS is administered in two stages: the Learning and Observation stage and the Informant Ratings stage. The Learning and Observation stage is administered directly to the examinee. The Observation portion entails the direct observation of the individual's responses on a sample of the informant rating items. The Informant Ratings stage is administered to the informant and is administered after the Learning and Observation stage. This stage contains the following subtests: Mobility, Communication, Independent Living/Self-Care, Self-Direction, and Economic Self-Sufficiency. The informant rates the examinee's level of independence using the following criteria: two points means the client performs the skill or task in question independently; one point means the client performs the skill or task with prompting or somewhat; zero points means the examinee does not perform the skill or task.

MAS conceptual development and content validity. The conceptual development of the MAS began when Clay Stearns, currently an administrator with the Missouri Institute of Mental Health (MIMH), recognized the limitations that characterize available measures of adaptive functioning. When the MAS contract was approved by MIMH, Stearns and Dunham considered the needs of MIMH clientele and assessment personnel and researched developmental stages to generate the individual test items, format, scoring, and interpretation. The individual items were analyzed, vetted, and sequenced via level of difficulty by the author and other experts in child development and intellectual disabilities. Once the MAS prototype was developed, it was administered to 25 individuals from ages five to 30. Items that relied upon excessive examiner judgment or that were overly difficult to score or interpret by either the examiner or the informant were eliminated. The norming version of the MAS resulted in 10 subtests administered in two stages, described below.

Learning. This series of subtests measures the individual's learning aptitude through assessment of reading, mathematics, visual memory, and verbal memory and requires the use of a reusable workbook.

Reading. The Reading subtest begins by measuring the extent the client can read individual words and increases in difficulty to measure reading comprehension. There are 13 items for this subtest.

Mathematics. The Mathematics subtests begins by measuring the client's ability to count simple objects and increased in difficulty to measure knowledge of ratios. There are 15 items on this subtest.

Verbal Memory. This subtest measures the client's ability to sustain verbal attention and recall verbally presented information, beginning with single words and increasing to complex sentences. There are 12 items on this subtest.

Visual Memory. This subtest measures the client's ability to remember a series of geometric shapes. The items begin with three items then increase in difficulty by increasing the number of figures to be remembered. There are six Visual Memory items.

Observation. This aspect of Stage I uses observations of the individual's adaptive skills as well as direct questions of up to 43 items that are embedded in the Informant Ratings section.

Informant ratings. This series of subtests measures the individual's adaptive behaviors through informant ratings of fine and gross motor kill, receptive and expressive language, independent daily living skills, self-direction, and economic self-sufficiency.

Mobility. This subtest measures fine motor skills (skill in using one's hands to meet the demands of daily living) and gross motor skills (skill in using large muscle groups in the process of ambulation and employment). There are 16 Fine Motor subscale items and 18 Gross Motor subscale items.

Communication. This subtest measures individuals' skill in expressing themselves and ability to understand what others are saying to them. There are 22 Expressive Language subscale items and 21 Receptive Language subscale items.

Independent Living/Self-Care. This subtest measures individuals' ability to meet the age appropriate self-help demands of daily living. It measures skills required for dressing, toileting, meal preparation and managing domestic responsibilities. There are 44 items that comprise this scale.

Self-Direction. This subtest measures the individual's ability to sustain attention, follow through on directions, set goals, and make appropriate decisions regarding personal and economic safety. There are 33 items that comprise this scale.

Economic Self-Sufficiency. This subtest measures the individual's ability to find and sustain employment. It includes the ability to understand and manage money and to understand employment contexts and environments. This scale is administered to individuals 15 years and older.

The normative sample for the MAS included 722 individuals ages one to 79. The normative sample was broken down into 10 age groups: regarding race, there were 554 Caucasians (76.7%), 108 African Americans (15%), 20 Hispanics (2.8%), and 21 Asians (2.9%). Additionally, there were 19 other participants (2.6%) who identified as Native American, Pacific Islander, or biracial. A summary of the demographic variables for the normative sample is provided in Table 1. Approximately 10 percent of the participants had a documented disability, such as ADHD or learning disabilities. Most data were obtained from Kentucky although some of the participants were from Missouri, Illinois, and Tennessee. All examiners involved in the data collection for the norming were trained by the author of the MAS; there were six graduate students in school psychology and two practicing school psychologists involved in data collection. The norming procedures, including the MAS and the informed consent documents, were approved by Murray State University's Institutional Review Board.

This study aimed to measure the concurrent validity of the learning components of the MAS. The MAS was compared to other well-established learning ability measures, namely the

WISC-V and the KABC-II. The measurement of concurrent validity of the learning components of the MAS add to the previous studies that measure the validity and reliability of the MAS domains.

CHAPTER THREE: METHODS

Participants

This study evaluated 50 participants (m = 28; f = 22). The mean age of participants was 13.1 years, with a standard deviation of 5.8 years. The age of participants ranged from five to 29. Participants were recruited via convenience sampling, and data were collected from clients at the Murray State University Counseling and Assessment Center (CAC).

Procedures

This study was approved by Murray State University's IRB, and all data collection and informed consent procedures followed the approved protocol. The researcher collected consent from participants, or participants' parents if minors, and all data were collected in the CAC on the Murray State University campus. All cognitive ability test results and the MAS test results were analyzed in SPSS. Only raw scores from the IQ tests and the MAS were compared since the MAS does not generate standard scores.

Measures

Three different tests of cognitive ability, described in Chapter Two, were used in this study (WISC-V, WJ-IV, and KABC-2), as well as the MAS. The WISC-V (2014) is a norm-referenced, individually-administered test of intelligence designed for children ages six through 16 years, 11 months. The norm sample included 2,200 participants who were included in the sample in accordance with the distribution in the United States in terms of region of the country, socioeconomic status, and other important demographic variables. The WISC-V has been thoroughly researched and has excellent validity and reliability (Wechsler, 2014) and includes seven subtests which are combined to generate the full scale IQ. Three additional subtests, if administered, generates a full scale IQ as well as five factors: Verbal Comprehension, Visual Processing, Fluid Reasoning, Working Memory, and Processing Speed.

The WJ-IV is a norm-referenced test of cognitive functioning for ages two to over 90. The norming sample for the WJ-IV includes approximately 1,500 norming cases. The validity and reliability of the WJ-IV is well-established (Schrank, McGrew, & Mather, 2014). Included participants were distributed throughout the United States in terms relative to pertinent demographic variables to ensure normative accuracy. The WJ-IV consists of 18 subtests, the first seven of which are used to compose the General Intellectual Ability (GIA) scores; additional indices can be gained using supplemental subtests to compose broad CHC factors including: Comprehension-Knowledge (*Gc*), Fluid Reasoning (*Gf*), Working Memory (*Gwm*), Processing Speed (*Gs*), Auditory Processing (*Ga*), Long-term Retrieval (*Glr*), and Visual Processing (*Gv*) (Schrank, McGrew, & Mather, 2014)

The KABC-2, similar to the WISC-V, is a norm-referenced, individually-administered test of intellectual functioning for children ages three through 18 years, 11 months. The norming sample for this instrument included 3,025 children stratified in accordance with important demographic variables. The validity and reliability of the KABC-2, like the WISC-V and WJ-IV, are well-established (Kaufman & Kaufman, 2004). The KABC-2 consists of 18 subtests although only 10 subtests are used to generate the composite score (referred to as the Fluid-Crystallized Index) and five additional factors: Comprehension-Knowledge, Visual Processing, Fluid Reasoning, Long-Term Retrieval, and Short-Term Memory. Importantly, the factors on the

KABC-II correspond to the factors on the WISC-V and are highly correlated (Kaufman & Kaufman, 2004). As a result, for the data analysis, the verbal reasoning aspects from the WISC-V, WJ-IV, and the KABC-II (the Verbal Comprehension factor and the Comprehension-Knowledge factors, respectively) were combined to form the *Gc* factor (Newton & McGrew, 2010). Similarly, the Fluid Reasoning factors from these tests were combined to form the *Gf* factor, and the Working Memory factor (from the WISC-V and WJ-IV), and the Short-Term Memory factor (from the KABC-2) were combined. In this manner, the MAS subtests could be statistically compared to the overall combined cognitive ability factor and not to the individual factors from each cognitive ability test.

Finally, the MAS, described in Chapter Two, is a measure of adaptive behavior currently in development. It has been normed on 722 individuals ranging in age from one to 75. To date, several studies have established its test-retest reliability and its concurrent validity by comparing it to the Vineland-3 and the ABAS-3. Consistently, the reliability and validity studies on the MAS have provided strong evidence of both although none of these studies have been published (Janececk, 2017; Lang, 2018).

Hypothesis

It was hypothesized that the Learning components of the MAS would correlate well with the different cognitive ability factors from the intelligence tests.

Analyses

Spearman correlations were used to study the associations among the different MAS subtests and the IQ test indices. Unlike the Pearson correlation, Spearman was used because it is preferable for analyzing correlations when variables tend to be monotonic or curvilinear and when data is nonparametric or non-normally distributed (Field, 2013). A probability level of .05 was used to determine statistical significance.

CHAPTER FOUR: RESULTS AND DISCUSSION

Results

First, as noted in Table 1, the MAS subtests were correlated at the .05 level or higher on 33 of 45 possible pairings. The highest correlations (r_S = >.7) were found between Reading and Math, Reading and Verbal Memory, Reading and Self-Care, Receptive Language and Self-Care, and Self-Care and Self-Direction. Consistently, the lowest correlations (r_S= <.3) were noted between Math and Visual Memory, Visual Memory and Expressive Vocabulary, Visual Memory and Receptive Vocabulary, Visual Memory and Self-Care, and on six of the seven pairings with Gross Motor. The Gross Motor subtest correlated only with Expressive Vocabulary (r_S = .3)

Next, Spearman correlations between the MAS memory subtests and the different CHC factors revealed moderate correlations between the Verbal Memory and Crystallized Knowledge index (r_S = .4), Verbal Memory and Fluid Reasoning index (r_S = .4), and high correlations were discovered between the Verbal Memory and Short-Term Memory index (r_S = .7). The Visual Memory subtest correlated with the IQ Composite (r_S = .45) and with the Crystallized-Knowledge factor (r_S = .39). Overall, the hypothesis was accepted as the MAS memory scales demonstrated statistically significant correlation with the cognitive factors.

Discussion

This study first hypothesized that the learning components for the MAS would correlate well with the different cognitive ability factors measured by the WISC-V, WJ-IV, and KABC-II. The hypothesis was accepted given the resulting, statistically significant correlations. The current study's findings were consistent with previous research showing moderate-to-strong correlations between measures of adaptive functioning and cognitive ability (Harrison, 1987; Hayes & Farnille, 2003; Kenworthy, Case, Harms, Martin, & Wallace, 2009). This is important because under 42 C.F.R. § 425.9 C.S.R. 45-2.010 practitioners are required to measure learning, one of the six major areas of major life activity (Department of Health and Human Services, 2015). Other major life activity areas included self-care, expressive and receptive language, self-direction, capacity for independent living/economic self-sufficiency, and mobility. Many of the current measures of adaptive behavior (e.g., the Vineland-3 and the ABAS-3) provide informant ratings of these areas. However, none of the current commercially available measures of adaptive behavior have a learning component that directly assesses the applicant's abilities in these areas. Once again, while measures such as the ABAS-3 include learning scales that examine constructs such as functional academics, the MAS relies on direct responses from the examinee in addition to informant ratings of learning. The belief is that direct measures of learning can lead to increased validity and reliability for the assessment of adaptive behavior. Moreover, before any test can be offered for public consumption or used by psychologists, the test must be determined valid and reliable. This is clearly specified in the code of ethics for school psychologists, pertaining to the responsible use of assessment practices (National Association of School Psychologists, 2010).

CHAPTER FIVE: IMPLICATIONS, LIMITATIONS, AND FUTURE RESEARCH

Implications

The current study's results have various implications regarding adaptive behavior and cognitive assessment. It is apparent that the MAS's learning components are correlated with other measures of learning, including the KABC-2 NU and WISC-V. Moreover, the added learning component to the adaptive behavior domains provides a unique measure of behavior. With the reliance of both, learning ability and adaptive behavior on mental health classifications (via the DSM-5) and special education eligibility (via the IDEA), assessments such as the MAS will be vital in the continually evolving world of applied psychology.

Limitations

Due to the nature of applied psychometrics, all studies contain limitations. For the current study, limitations revolve around sample size, sampling procedures, and relatively narrow domains of learning items on the MAS. First, while the sample size of 50 was adequate for correlation measures, a larger sample size would further strengthen the results. Also, this study used convenience sampling in gathering participants, and is unlikely to be a true representation of the given population at large. This may affect generalization of current results to a larger population. Additionally, the learning components of the MAS included domains of reading, math, visual memory, and verbal memory. A broader range of learning components might strengthen the ties to CHC factors and prove to be a more effective measure of learning. However, it should be noted that the MAS is intended to be an adaptive measure containing learning components and not a pure or broad measure of overall cognitive ability.

Future Research

Further research with the MAS and learning scales is recommended before administering the MAS in applied settings. The MAS would benefit from further study comparing its adaptive domains to other adaptive assessments and broader populations. Furthermore, correlations of learning components of the MAS should be conducted on broader and more diverse populations, including those with typical and atypical development and those individuals with disabilities. Overall, the MAS appears to be a sufficient method for measuring adaptive behavior that provides a brief learning component.

Table 1.

MAS Subtest Intercorrelation Matrix

	Read	Math	Verb Mem.	Vis. Mem	Express.	Recept.	Fine	Gross	SC	SD
Read	---	.726*	.720*	.395*	.684*	.648*	.611*	.178.	.779*	.567*
Math			.567*	.246	.622*	.485*	.707*	.154	.609*	.500*
Verb. Mem.				.294*	.561*	.512*	.577*	.209	.673*	.502*
Vis. Mem.					.255	.228	.158	.277	.275	.365*
Express.						.647*	.610*	.318*	.655*	.479*
Recept.							.447*	.274	.790*	.660*
Fine								.126	.610*	.419*
Gross									.361*	.267
SC										.715*

n = 50

*significant at .05 level or less

Table 2.

MAS Memory Variables and IQ Variables

	IQ Comp.	IQ Crystal.	IQ Fluid	IQ STM
MAS Verbal Mem.	.270	.479*	.427*	.746*
MAS Visual Mem.	.453*	.398*	.218	.301

n = ranged from 39 to 50

*significant at .05 level or less

References

Adapt. (2018). In *Online Etymology Dictionary*. Retrieved from http://www.dictionary.com/browse/adapt

Alexander, R. M. (2017). *The relation between intelligence and adaptive behavior: A meta-analysis* (Doctoral dissertation). Retrieved from ERIC. (ED577656).

American Association on Intellectual and Developmental Disabilities. (2018). *Definition of intellectual disabiltiy.* Retrieved from http://aaidd.org/intellectual-disability/definition#.Ww327e4vzIU

American Association on Mental Retardation (2002). *Mental retardation: Definition, classification, and systems of supports*. Author: Washington, DC, USA

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing

Atkins v. Virginia, 536 US 304 (2002).

Binet, A. (1916). *New methods for the diagnosis of the intellectual level of subnormals*. (E. Kite, Trans.). Vineland, NJ: Publications of the Training School at Vineland. (Original work published 1905)

Brady, N. n., Fleming, K., Romine, R. S., Holbrook, A., Muller, K., & Kasari, C. (2018). Concurrent validity and reliability for the Communication Complexity Scale. *American Journal of Speech-Language Pathology*, *27*(1), 237-246. doi:10.1044/2017_AJSLP-17-0106

Carrol, J. B. (1993). *Human cognitive abilities: A survey of factor analytic studies*. New York, NY: Cambridge University Press.

Cattell, J. M. (1890). Mental tests and measurements. *Mind*, 15. 373-381.

Crawford v. Honig, 37 F.3d 485 (9th Cir. 1995).

Das, J. P., Naglieri, J. A., & Kirby, J. R. (1994). *Assessment of cognitive processes*. Needham Heights, MA: Allyn & Bacon

Decker, S. L., Hale, J. B., & Flanagan, D. P. (2013). Professional practice issues in the assessment of cognitive functioning for educational applications. *Psychology in the Schools*, *50*(3), 300-313. doi: 10.1002/pits.21675

DeFife, J. A., Drill, R., Nakash, O., & Westen, D. (2010). Agreement between clinician and patient ratings of adaptive functioning and developmental history. *The American Journal Of Psychiatry*, *167*(12), 1472-1478. doi:10.1176/appi.ajp.2010.09101489

Department of Health and Human Services (2015). *The home and community-based settings rule*. 42 CFR Part 430, 431 et al. Medicaid Programs: State Plans. http://www.sos.mo.gov/cmsimages/adrules/main/agency/9csr/9c45-2.doc

Diana v. State Board of Education, CA 70 RFT (N.D. Cal. 1970).

Fancher, R. E. & Rutherford, A. (2016). *Pioneers in psychology* (5th ed.). New York, NY: W.W. Norton & Company

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). Thousand Oaks, CA: SAGE Publications.

Flanagan, D. P., Ortiz, S. O., Alfonso, V. G., & Dynda, A. M. (2014). Best practices in cognitive assessment. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology V* (pp.

633-660). Bethesda, MD: National Association of School Psychology

Galton, F. (1869). *Hereditary genius: An inquiry into its laws and consequences*. London, England: Macmillan and Co.

Gardner, H. (1993). *Frames of mind: The theory of multiple intelligences.* New York, NY: Basic Books

Goldstein, E. B. (2011). *Cognitive psychology: Connecting mind, research, and everyday experience* (3rd ed.) Belmont, CA: Cengage Learning

Guadalupe v. Tempe, 587 F.2d 1022 (9th Cir. 1972)

Harrison, P. L. (1987). Research with adaptive behavior scales. *The Journal of Special Education 21*(1), 37-68.

Harrsion, P. L. & Raineri, G. (2014). Best practices in the assessment of adaptive behavior. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology V* (pp. 605-616). Bethesda, MD: National Association of School Psychology

Hayes, S. C., & Farnill, D. (2003). Correlations for the Vineland Adaptive Behavior Scales with Kaufman Brief Intelligence Test in a forensic sample. *Psychological Reports*, *92*(2), 573–580.

Hobson v. Hansen, 269 F. Supp. 401 (D.D.C. 1967)

Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004)

Janecek, H. (2017). Concurrent validity of the Missouri Ability Scale. *Murray State Theses and Dissertations*. 38. Retrieved from http://digitalcommons.murraystate.edu/etd/38

Kenworthy, L., Case, L., Harms, M. B., Martin, A., & Wallace, G. L. (2009). Adaptive behavior ratings correlate with symptomatology and IQ among individuals with high-functioning autism spectrum disorders. *Journal of Autism and Developmental Disorders, 40* (4). 416-423. doi:10.1007/s10803-009-0911-4

Kaufman, A. S. & Kaufman, N. L. (2004). *KABC-II manual*: *Kaufman Assessment Battery for Children* (2nd ed.) Circle Pines, MN: AGS Publishing.

Lang, T. (2018). *The test-retest reliability of the Missouri Adaptive Behavior Inventory*. Unpublished manuscript, Murray State University, Murray, KY.

Larry P. v. Riles, 495 F. Supp. 926 (1979).

Matthews, N. L., Pollard, E., Ober-Reynolds, S., Kirwan, J., Malligo, A., & Smith, C. J. (2015). Revisiting cognitive and adaptive functioning in children and adolescents with autism spectrum disorder. *Journal Of Autism And Developmental Disorders*, *45*(1), 138-156. doi:10.1007/s10803-014-2200-0

McMillan, J. H. (2016). *Fundamentals of educational research* (7th ed.). New York, NY: Pearson Education, Inc.

Mohr, C., Tonge, B. J., Taffe, J., Rymill, A., Collins, D., Keating, C., & Einfeld, S. L. (2011). Inter-rater reliability of the Developmental Behaviour Checklist for adults in community accommodation settings. *Journal of Intellectual Disability Research*, *55*(7), 710-713. doi:10.1111/j.1365-2788.2010.01372.x

Mouga, S., Almeida, J., Café, C., Duque, F., & Oliveira, G. (2015). Adaptive profiles in autism and other neurodevelopmental disorders. *Journal of Autism And Developmental*

Disorders, *45*(4), 1001-1012. doi:10.1007/s10803-014-2256-x

Naglieri, J. A., & Das, J. P. (1997). *Cognitive Assessment System. Administration and scoring manual*. *Interpretive handbook*. Itasca, IL: Riverside.

National Research Council Committee on Disability Determination for Mental Retardation (2002). *Mental retardation: Determining eligibility for social security benefits*. D. J. Reschly, T. G. Myers, & C. R. Hartel (Eds.). Washington, D.C.: National Academies Press.

Newton, J. H., & McGrew, K. S. (2010). Introduction to the special issue: Current research in Cattell-Horn-Carroll-Based Assessment. *Psychology In The Schools*, *47*(7), 621-634.

Nishanimut, S. P., & Padakannaya, P. (2014). Cognitive Assessment System (CAS): A review. *Psychological Studies*, *59*(4), 345-350. doi:10.1007/s12646-014-0253-y

Nolen-Hoeksema, S. (2010). *Abnormal psychology* (5th ed.). Colombus, OH: McGraw-Hill Education

PASE v. Hannon, 506 F. Supp. 831 (N.D. Ill. 1980).

Piaget, J. (1950). *The psychology of intelligence.* New York, NY: Routledge

Price, J. A., Morris, Z. A., & Costello, S. (2018). The application of adaptive behaviour models: A systematic review. *Behavioral Sciences*, *8*(1), 11. http://doi.org/10.3390/bs8010011

Price, P. C. (2015). *Research methods in psychology*. Retrieved from https://opentextbc.ca/researchmethods

Pugliese, C. E., Anthony, L., Strang, J. F., Dudley, K., Wallace, G. L., & Kenworthy, L. (2015). Increasing adaptive behavior skill deficits from childhood to adolescence in autism spectrum disorder: Role of executive function. *Journal of Autism and Developmental Disorders, 45*(6), 1579-1587. doi:10.1007/s10803-014-2309-1

Pugliese, C. E., Anthony, L. G., Strang, J. F., Dudley, K., Wallace, G. L., Naiman, D. Q., & Kenworthy, L. (2016). Longitudinal examination of adaptive behavior in autism spectrum disorders: Influence of executive function. *Journal Of Autism And Developmental Disorders, 46*(2), 467-477. doi:10.1007/s10803-015-2584-5

Sattler, J. M. (2008). *Assessment of children: Cognitive foundations* (5th ed.). La Mesa, CA: Jerome M. Sattler, Publisher, Inc.

Schrank, F. A., McGrew, K. S., & Mather, N. (2014). *Woodcock-Johnson IV Tests of Cognitive Abilities*. Rolling Meadows, IL: Riverside.

Sellman, W. S. (2004). *Predicting readiness for military service: How enlistment standards are established.* Retrieved from https://www.nagb.gov/content/nagb/assets/documents/what-we-do/sellman.doc

Sotelo-Dynega, M., & Dixon, S. G. (2014). Cognitive assessment practices: A survey of school psychologists. *Psychology in the Schools, 51*(10), 1031-1045.

Spatz, C. (2011). *Basic statistics: Tales of distributions* (10th ed.). Belmont, CA: Wadsworth, Cengage Learning

Stern, W. (1914). *The psychological method of testing intelligence*. Baltimore, MD: Warwick & York, Inc.

Stough, C. (2015). *How has intelligence testing changed throughout history?* Retrieved from https://www.weforum.org/agenda/2015/10/how-has-intelligence-testing-changed-throughout-history/

Tassé, M. J. (2009). Adaptive behavior assessment and the diagnosis of mental retardation in capital cases. *Applied Neuropsychology*, *16*(2), 114-123. doi:10.1080/09084280902864451

Tassé, M. J., Schalock, R. L., Balboni, G., Bersani, H. J., Borthwick-Duffy, S. A., Spreat, S., & ... Zhang, D. (2012). The construct of adaptive behavior: Its conceptualization, measurement, and use in the field of intellectual disability. *American Journal on Intellectual and Developmental Disabilities*, *117*(4), 291-303. doi:10.1352/1944-7558-117.4.291

Tassé, M. m., Luckasson, R., & Schalock, R. L. (2016). The relation between intellectual functioning and adaptive behavior in the diagnosis of intellectual disability. *Intellectual & Developmental Disabilities*, *54*(6), 381-390. doi:10.1352/1934-9556-54.6.381

Tassé, M. J., Schalock, R. L., Balboni, G., Spreat, S., & Navas, P. (2016). Validity and reliability of the Diagnostic Adaptive Behaviour Scale. *Journal of Intellectual Disability Research*, *60*(1), 80-88. doi:10.1111/jir.12239

Terman, L. (1916). *The measurement of intelligence.* Cambridge, MA: The Riverside Press.

Thompson, N. (2007). *Enlisted selection and classification tests: Precursors of the ASVAB.* San Antonio, TX: Operational Technologies Corporation. Retrieved from http://www.dtic.mil/dtic/tr/fulltext/u2/a594291.pdf

Tomporowski, P. D., Davis, C. L., Miller, P. H., & Naglieri, J. A. (2008). Exercise and children's intelligence, cognition, and academic achievement. *Educational Psychology*

Review, *20*(2), 111-131. doi:10.1007/s10648-007-9057-0

Wechsler, D. (1939). *The measurement of adult intelligence.* Baltimore, MD: Williams & Wilkins.

Wechsler, D. (1958). *The measurement and appraisal of adult intelligence* (4th ed.). Baltimore, MD: Williams & Wilkins Co.

Wechsler, D. (2014). *Wechsler Intelligence Scale for Children*, *Fifth Edition*. San Antonio, TX: Psychological Corporation.

Wechsler, D. (2014). *WISC-V: Technical and interpretive manual*. Bloomington, MN: Pearson, Inc.