# Measuring Formal Intelligence in the Informal Learner: A Case Study of Hmong American Students and Cognitive Assessment

**by**

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## Abstract

The purpose of this study was to illustrate the impracticality of using mainstream formalized methods of intellectual assessments to assess Hmong American children, who came from an informal learning environment. One hundred and fifty-four Hmong American students, ages 5-18, and 51 Caucasian students, ages 5-14, were assessed using the Kaufman Assessment Battery for Children – Second Edition (KABC-II), along with 46 Hmong American students, ages 7-14, who were assessed using the Wechsler Intelligence Scale for Children – Fifth Edition (WISC-V). Results showed that Hmong American students scored one standard deviation below the national mean on both the KABC-II and the WISC-V. These low scores were observed from samples of kindergarteners, kindergarten through 3rd grade, and students in the upper-level grades compared to a sample of Caucasian students from the same area. Some implications and future research directions are discussed.

**Keywords:** IQ tests, special education, English language learners, Hmong American students

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## Introduction

Using intelligence tests to predict a student's academic success or level of skill in the classroom (Benjamin, 2009), as well as to identify students for special education, is not new (Deary, Strand, Smith, & Fernandes, 2007; Kaufman, 2009; Laundra, & Sutton, 2008; Zavala & Mims, 1983). Indeed, the use of intelligence assessments to predict a student's academic success officially began in France in the beginning of the 20th century. Subsequently, by 1911, Alfred Binet's test of intelligence was exported from France across Europe and to the United States (Benjamin, 2009; Wasserman, 2012). The intellectual assessments developed in France and used across Europe and the West have been influenced and constructed based on the formalized systems of education in which they are used (Cole, 2005; Gray, 2008; Tokuhama-Espinosa, 2011). Current intellectual assessments measure predicted academic success in formal educational settings. As such, it can be said that these intellectual assessments measure a person's formal intelligence. The method of intellectual testing to predict a student's level of skill in the formalized education system was created in the beginning of the 20th century and is still used today; however, this formal education system is not the cultural norm for all students, especially for language and ethnic minority students (Laundra, & Sutton, 2008; Marshall & DeCapua, 2013; Zavala & Mims, 1983).

Mainstream American classrooms present challenges for learners of different ethnicities and learning profiles that lack congruency with the European and American formalized educational model of instruction (Marshall, 1998; Marshall & DeCapua, 2013). Hvitfeldt (1986) and Marshall (1998) suggest that the Hmong American ethnic minority group has experienced difficulties adjusting to the American educational system due to living and learning styles that are embedded in traditional Hmong American culture. As a result, students of Hmong American ethnicity and culture may appear to be behind academically and/or socially, which has led to many being erroneously evaluated for special education (Marshall 1998; Marshall & DeCapua, 2013; Sullivan, 2011). When evaluated for special education, many of these students will be administered an intellectual assessment. Due to the cultural and linguistic bias of these assessments, these students will likely earn scores that are culturally irrelevant and lower than their true intellectual abilities (Xiong, Yang, & Lee, 2008). Thus, they will be assigned a formalized, western intellectual score (Benson, 2003). The gap for linguistically and ethnically diverse students has yet to be fully examined and researched; therefore, the purpose of this paper is to illustrate the impracticality of using these instruments to assess populations of individuals, specifically Hmong American children, who do not follow cultural patterns of living and learning that predicate the cognitive processes these assessments measure.

## Literature Review

### Intellectual Testing

According to Wasserman (2012) there is no agreed upon specific definition for intelligence in the field of psychology; however, as defined by Merriam-Webster's Online Dictionary (2017), intelligence is one's ability to reason, apply knowledge, think abstractly, and process information. Universal education in France in the early 20$^{th}$ century sparked the beginning of measuring and placing a numerical value on a person's intelligence (Wasserman, 2012; Wechsler, 2014). The goal of this practice was to predict possible future academic struggles for students in the educational system (Benjamin, 2009; Wasserman, 2012; Wechsler, 2014). In 1905, French psychologist Alfred Binet created the first official instrument to measure intelligence (Benjamin, 2009; Wasserman, 2012). Years later, the practice of assessing a student's intelligence in a school setting was implemented across Europe and in the United States

(Benjamin, 2009; Wasserman, 2012). Over time, different intellectual assessments were created and refined for use in clinical, school, and government settings (Benjamin, 2009; Wechsler, 2014). Today, intellectual assessments are administered across multiple settings to assess intellectual disabilities, giftedness, and brain and behavioral disorders (Deary, et al., 2007; Kaufman, 2009).

**Cattell-Horn-Carrol Model (CHC)**

From the beginning of the 20$^{th}$ century until present day the tools used to measure intelligence have evolved tremendously, and currently, many assessments are based on one of two prominent models: Cattell-Horn-Carrol (CHC) and Luria (Schrank, McGrew, & Mather, 2015; Wechsler, 2014).

The CHC model of intelligence is a *taxonomy* of intellectual abilities derived from a single factor of intelligence. The model serves as a set of theoretical explanations of differing cognitive abilities within groups of people (Schneider & McGrew, 2012). According to Kaufman & Kaufman (2004), the development of the CHC model comes from three separate scientists: Raymond Cattell, John Carroll, and John Horn. Raymond Cattell's main theory of intelligence consisted of two dominant abilities: Crystallized Abilities (G*c*) and Fluid Reasoning (G*f*) (Kaufman & Kaufman, 2004). Raymond Cattell's theory suggested that G*f*-G*c* were the two dominant types of intellectual abilities, and therefore, carried the most statistical significance in calculating one's overall intelligence score (Schrank et al., 2015). Kaufman & Kaufman (2004) define G*c* as the ability to "…demonstrate the breadth and depth of knowledge acquired by culture," and G*f* as "…solving novel problems by using reasoning abilities such as induction and deduction" (p.17). John Horn and John Carroll expanded Cattell's theory to include more measurable abilities than the dominant G*f*-G*c*, which subsequently created the Cattell-Horn-

Carroll theory of intelligence (Kaufman & Kaufman, 2004). Current assessments based on the CHC model measure multiple specific abilities associated with G*f*-G*c* (Schrank et al., 2015). The specific abilities associated with G*f* are those dealing with all abstract problem solving, inductive and deductive reasoning, categorical thinking, and pattern recognition. Those associated with G*c* are abilities related to knowledge learned by culture, knowledge related to vocabulary, and general informational knowledge (Schrank et al., 2015). Scientists of the CHC model have determined these larger abilities and the specific abilities associated with them are the strongest predictor of general life outcomes and performance (Schrank et al., 2015).

### Luria Model

Alexander Luria, a neuropsychologist in the Soviet Union in the mid twentieth century, theorized that the human brain had three separate co-active systems, or processes, working at all times (Kaufman & Kaufman, 2004; Luria, 1973; Naglieri, Das, & Goldstein, 2012). Rather than measuring independent intellectual abilities, Luria believed that measuring how the brain processed information in three separate areas was a better indicator for predicting how a person would perform academically and in daily life (Naglieri & Otero, 2011; Naglieri et al., 2012). Luria (1973) and Kaufman and Kaufman (2004) describe these three separate processing abilities as functional blocks in the human brain responsible for: arousal from and attention to incoming stimuli (Block 1); coding, analyzing, and storing information and incoming stimuli (Block 2); and, application of executive functions as well as planning behaviors (Block 3) (Kaufman & Kaufman, 2004; Luria, 1973). Luria's work was the precursor to Das, Kirby, and Jarman's work and later Das, Kirby, and Naglieri's Planning, Attention, Simultaneous, Successive (PASS) model of cognitive processing which further theorizes that cognition is organized into three separate, co-active systems and four processes (Das, Naglieri, & Kirby, 1994; Naglieri et al., 2012). Another trait of the Luria model, and those based on it, is that it excludes verbal reasoning from the assessment, making it a better indicator of true processing in the human brain rather than simply what the brain has acquired from surrounding culture (Naglieri et al., 2012).

As opposed to measuring general intellectual factors, such as those found in the CHC model, Naglieri et al. (2012) indicate that the Luria model of analyzing and processing recognizes the sophistication of the different areas of brain functioning and processing. Ultimately, recognition of the effect of psychological processing in the brain and Luria's model has gained increased recognition in the world of psychometric testing and assessment creation (Naglieri & Otero, 2011).

**Application of CHC and Luria Model**

Both models of intellectual measurement have been influential in the field of assessment creation and serve as the blueprint for many prominent assessments today (Das et al., 1994; Schrank et al., 2015). In clinical and educational settings, the two most widely used assessments are the Wechsler series and the Kaufman series. Both assessments are based on and influenced by the CHC and Luria models (Drozdick, Wahlstrom, Zhu, & Weiss, 2012; Kaufman & Kaufman, 2004; Wechsler, 2014).

**The Wechsler Series of Assessments.** David Wechsler developed the Wechsler series of intellectual assessments in the 1930s (Wechsler, 2014). They are designed to measure different intellectual abilities such as Fluid Reasoning (G*f*), Visual/Spatial Reasoning (G*v*), and Verbal Knowledge (G*c*) (Drozdick et al., 2012; Wechsler, 2014). Since its inception, the Wechsler series of intellectual assessments have influenced research in the field for half a century and currently they are the most widely used internationally in clinical and educational settings (Kaufman, Flanagan, Alfonso, & Mascolo, 2006). Drozdick et al., (2012) further state that the incorporation of data and research from multiple areas of practice and research are what make the Wechsler series of intellectual assessments outstanding, leading clinicians and professionals in the field of psychometric testing in the United States and abroad to strongly prefer it. As opposed to its predecessor, which only gave a single, overall intellectual score, the newest series of the Wechsler assessments, the Wechsler Intelligence Scale for Children – Fifth Edition (WISC-V), appeals to clinicians and other professionals as it utilizes the CHC model and measures multiple indices to identify strengths and weaknesses in a student's cognitive profile (Wechsler, 2014).

**The Kaufman Series.** One other prominent assessment utilizing the CHC model is the Kaufman series (Kaufman & Kaufman, 2004; Schrank et al., 2015), which was originally developed in 1983 by Alan and Nadeen Kaufman (Kaufman & Kaufman, 2004). Its most current edition, the Kaufman Assessment Battery for Children – Second Edition (KABC-II), allows examiners a two-prong approach to measure intelligence and processing (Kaufman & Kaufman, 2004). The examiner can use the CHC model to measure broad and narrow intellectual abilities or chose to use the Luria model to measure processing abilities, minus the measure of G*c* (Kaufman & Kaufman, 2004). According to Singer, Lichtenberger, Kaufman, Kaufman, and Kaufman (2012), this dual theoretical model is a factor that makes the KABC-II a choice and *gold standard* assessment for professionals in the field (Fletcher-Janzen, 2009).

## Formal and Informal Learners

Although a large number of students in the United States, European, and global educational systems may be considered formal learners ideally matched to these assessments (Benjamin, 2009; Gray, 2008; Tokuhama-Espinosa, 2011), there is also a population of students that are informal learners for whom the assessments may not be as ideal (Marshall, 1998; Marshall & DeCapua, 2013). It is acknowledged that the public education system in the United

States and Europe is based on the formal model of education (Gray, 2008; Marshall, 1998; Marshall & DeCapua, 2013; Tokuhama-Espinosa, 2011). This formal model of education is characterized by utilizing pre-planned lessons, licensed teachers, and structured classrooms (Marshall, 1998; Marshall & DeCapua, 2013). Professionals in the field of formal education base instructional methods and services on the assumption that each learner carries innate academic, cognitive processing, and learning styles that transcend culture. Within this formal educational system are two types of learners: formal and informal (Marshall, 1998; Marshall & DeCapua, 2013).

Marshall and DeCapua (2013) describe the formal learner as one who learns individually through abstract concepts, experiences removed from daily life, assessment by examination closely related with literacy, and printed resources. Formal learning and education are based on scientific analysis, categorization, and organization of ideas and information (Marshall, 1998; Marshall & DeCapua, 2013). Research by Fierro (1997) and Massachi (2000) indicate that Caucasian students typically demonstrate this style of reasoning and learning, suggesting that it is a product of the more formalized Caucasian culture, as a whole. According to Marshall and DeCapua (2013), informal learning is based on events occurring naturally and as part of daily life centering on the socio-cultural practices of a community. Informal learners are collectivists who learn pragmatically through tasks that are immediately relevant to everyday life; formal learners, on the other hand, focus more on decontextualized tasks or lessons (Marshall & DeCapua, 2013). Informal learners have historically relied on oral transmission of information and knowledge rather than written word and script (Cole, 2005; Marshall & DeCapua, 2013; McVee, Dunsmore, & Gavelek, 2005). As such, the scientific, decontextualized, literacy-reliant formal educational systems are difficult for informal learners: these students may appear to be less able in the classroom setting, not because of learning or cognitive problems, but because of their alternative style of learning, which is connected to cognition and how they process information and informally reason (Cole, 2005; Luria, 1973; McVee et al., 2005; Naglieri et al., 2012; Voss, Perkins, & Segal, 1991).

**Assessing the Intelligence and Processing Abilities of Informal Learners**

Within our biased formalized system of education, there are informal learners that struggle with content, teaching styles, and curriculum. As such, they may be erroneously categorized as academically disabled or less than able in the classroom (Marshall, 1998; Marshall & DeCapua, 2013; Sullivan, 2011). For example, Cole (2005) describes research conducted in Mexico on Mayan children with no formal education versus Mayan children with one or more years of formal schooling. When presented tasks that required more abstract and categorical thinking the students with no formal schooling demonstrated lower abilities than those with formal education (Cole, 2005). Similarly, work done by Alexander Luria with non-literate subjects with no formal education indicates that tasks requiring abstract reasoning, categorical thinking, and classification abilities were more difficult for them (Marshall, 1998). Denny (1991) found that word association and categorization is culturally relative, so much so that it is a pre-requisite for activities that require analyzing information in a specific way, such as defining, categorizing, classifying, and synthesizing. As a result, decontextualized ways of thinking and learning make tasks based on generalization, classification, and abstract thinking much more difficult for informal learners, Hmong American students specifically (Denny, 1991; Hvitfeldt, 1986; Marshall, 1998).

**Hmong American Students and Academics**

The Hmong American population, like many other refugee groups, came from a culture with no history of literacy but a rich history of oral traditions and informal learning at home and in their communities (Hvitfeldt, 1986; Marshall, 1998). Several studies have suggested that Hmong Americans have historically had difficulty with the formalized educational system when compared to other cultural and linguistic minorities (Bliatout, Downing, Lewis, & Yang, 1988; Goldstein, 1985; Hvitfeldt, 1986; Marshall, 1998; Rumbaut & Ima, 1988; Trueba, Jacobs, & Kirton, 1990; Walker, 1989; Walker-Moffat, 1995; Xiong & Lee, 2011). Furthermore, Hmong Americans currently continue to face difficulties in the formal education system which cannot simply be attributed to lack of motivation or desire for education, lack of acculturation or assimilation, or any perceived linguistic difficulty (Bliatout, et al., 1988; Marshall, 1998; Rumbaut & Ima, 1988; Xiong et al., 2008). In actuality, Hmong American children may possess different mental schemata, a mental framework of processing and reasoning (Cole, 2005; McVee et al., 2005), making the formalized methods of reasoning and learning they face in school more challenging. Thus, when evaluated for special education, these informal learners will likely be given a formalized intellectual or cognitive processing assessment to predict academic skills and determine if a cognitive deficit or learning disability is present (Deary et al., 2007; Kaufman, 2009). Sullivan (2011) states that over- and under- representations exist in special education for bilingual children in our educational system, suggesting that it is partly due to inaccuracies in intellectual and cognitive processing assessments.

Many of the assessments Hmong American children are given have nonverbal and *culture-free* portions that Greenfield (1998) points out are in fact, very culturally biased. These nonverbal portions of assessments, such as the KABC-II and the WISC-V, have nonverbal portions containing matrices and other mental puzzles prompting children to find missing parts, categorize parts and information, or distinguish parts that do not belong to the general sequence

(Kaufman & Kaufman, 2004; Wechsler, 2014). Greenfield (1998) states that matrices are obsolete in some cultures, thus making them meaningless and poor indictors of intelligence and processing abilities for some. Hvitfeldt (1986) and Denny (1991) point out that asking informal learners to abstractly reason and categorize items into groups may be culturally irrelevant to some, making this style of cognitive measurement unfair and unreliable for many, including Hmong American children.

A sizeable segment of Hmong American students' true intellectual abilities may not be indicated by the current intellectual and cognitive processing measures administered to predict academic achievement. As Benson (2003) points out, these assessments are merely western intellectual and processing scores, created to measure the *formal learner.* A large segment of Hmong American students are *informal learners*; therefore, they may not be accurately served by the current methods of instruction and assessment (Denny, 1991; Hvitfeldt, 1986; Marshall, 1998).

Although Hmong Americans have been theoretically classified as informal learners, it should be noted that learning is a byproduct of one's reasoning abilities (Cole, 2005; Marshall, 1998; Marshall & DeCapua, 2013; McVee et al., 2005). Voss et al. (1991) state that all humans informally reason and, therefore, informally learn, to some degree. They further state that informal reasoning and learning are necessary to all humans. Johnson and Blair (1991) add that although formal reasoning and learning styles may be considered, by some, the superior of the two, this is a false assumption. Informal reasoning and the learning style it produces are of equal importance to humans in daily and professional life; however, since the educational system of the United States and many developed countries is highly formalized, people from more formal cultures, such as the Caucasian culture (Fierro, 1997; Massachi, 2000), may achieve better, academically, than those from informal cultures (Johnson & Blair, 1991; Marshall, 1998; Marshall & DeCapua, 2013; Miller-Jones, 1981; Miller-Jones, 1989; Miller-Jones, 1991). Therefore, the informal reasoning and learning styles of Hmong Americans and the Hmong American culture is not inferior to formal reasoning and learning. It is simply less effective in a system that values formal reasoning and learning styles (Marshall, 1998; Marshall & DeCapua, 2013).

This paper illustrates the impracticality of using formalized instruments to assess Hmong American children, who do not follow cultural patterns of living and learning that predicate the cognitive processes these assessments measure.

## Methods

### Sample and Data

Data for the present study were part of the first author's on-going work with students referred for an intellectual assessment. This assessment serves as a partial completion of an initial comprehensive measurement to establish certain state-defined criteria and eligibility for special education services, for some participants. Some participants were also students who were being re-evaluated per Minnesota state law to determine if they demonstrated a continuing need for special education services. Between August 2012 and June 2017, 154 Hmong American students (113 males and 41 females), ages 5 to 18 (mean = 10.41, SD = 3.31) and 51 Caucasian students (41 males and 10 females), ages 5 to 14 (mean = 9.64, SD = 2.41) from four separate public charter schools, were assessed using the KABC-II. In addition, 46 Hmong American students were also assessed using the WISC-V. Unfortunately, full data on the children's ages and gender were not collected at the time of the WISC-V assessment; however, all examinees were ages 7-14. All examinees, Hmong American and Caucasian, were from Minnesota.

Although the sample of Caucasian students administered the KABC-II was approximately one-third of the sample of Hmong American students, the evidence suggests a consistent pattern of mean scores across studies for the Caucasian population, supported by research done by Kaufman and Kaufman (2004) Dale, McIntosh, Rothlisberg, Ward, and Bradley (2011), and Scheiber and Kaufman (2015). As such, we feel confident that this small sample still serves as a valid representation of the overall Caucasian student population.

**Procedure**

All students assessed and included in this study were evaluated by the first author for special education services for the first time or were being re-evaluated for special education services per Minnesota state law (Minnesota Revisor of Statutes, 2016). These students were showing significant struggle in school academically and/or behaviorally. In response to their struggle, parents and/or teachers referred them to the child study team for further review. The child study team comprised of the student’s general education teacher, a special education teacher, a school psychologist, a special education director, a behavior specialist (depending on the nature of the student’s concern), and a designated administrative/district representative of the school. The purpose of the child study team was to determine if an evaluation for special education was to be done and what instruments and procedures would be used. For initial assessments of students for special education, a parental meeting was held to discuss concerns surrounding the student in need and the process of evaluation for special education. As per state law, when students are re-evaluated, parents are informed that the re-assessment is required to ensure that their child is still in need of special education services. State law also stipulates that these re-evaluations must be performed every three years from the time the child initially entered into special education (Minnesota Revisor of Statutes, 2016). Parents consented to their child’s re-evaluation either in person or by mail via a signed document.

Once parental consent was obtained, the school psychologist met with the child to conduct the assessment. All assessments were given in English and took about 25-75 minutes to administer, depending on the assessment and the age of the child (Kaufman & Kaufman, 2004; Wechsler, 2014). If the child did not speak or understand English well enough to comprehend the assessment questions and directions, a qualified and trained interpreter was provided.

**Measures**

*Kaufman Assessment Battery for Children - Second Edition (*KABC-II). The KABC-II (Kaufman & Kaufman, 2004) is an assessment tool used to measure the intellectual and processing abilities of children and young adults. It contains three separate overall scores that can be generated depending on which of the multiple subtests in the assessment are administered. The Fluid Crystallized Index (FCI) score, following the CHC model, is derived from an administration of 10 separate subtests measuring five different indices: Short-Term Memory/Sequential Processing/G*sm*, Visual-Spatial Processing/Simultaneous/G*v*, Fluid Reasoning/Planning Ability/G*f*, Long-Term Storage and Retrieval/Learning Ability/G*lr*, and Verbal Knowledge/Crystallized Abilities/G*c*. The Mental Processing Index (MPI) score, following the Luria model, is derived from 8 separate subtests measuring four different indices: G*sm*, G*v*, G*f*, and G*lr*. The Nonverbal Index (NVI) score consists of 5 subtests, two from the G*v* index, two from the G*f* index, and one from the G*sm* index, and is used only when the child's verbal abilities are compromised or he or she is not able to understand the language of administration. For children ages 4-6, only the indices G*sm*, G*v*, G*lr*, and G*c* can be administered and measured as the G*f* index is not yet distinguishable from G*v* (Kaufman & Kaufman, 2004).

The KABC-II can be administered to children ages 3-18 and takes between 25- to 60-

minutes to administer for the MPI score and 30- to 75-minutes to administer for the FCI score. It has a mean score of 100 and a standard deviation of 15 based on a national representative sample of 3,025 children ages 3-18. Thus, scores between 85 and 115 are considered to be in the average range of intellectual functioning (Kaufman & Kaufman, 2004).

*Wechsler Intelligence Scale for Children – Fifth Edition* (WISC-V). The WISC-V is an assessment tool used to measure the intellectual and processing abilities of children and young adults. The WISC-V has one global score that is generated from five indices measuring G*c*, G*v*, G*f*, G*sm*, and Processing Speed/G*s* (Wechler, 2014). The WISC-V also has 5 ancillary indices, including: Quantitative Reasoning, Auditory Working Memory, Nonverbal, General Abilities, and Cognitive Proficiency. The ancillary indices are derived from combining primary and secondary subtests from the battery and can give the examiner additional information about the child's cognitive abilities (Wechsler, 2014). It can be administered to children ages 6-16 and takes approximately 60 minutes to administer. It was nationally standardized from 2013 to 2014 with a representative sample of 2,200 children ages of 6 to 16 (Wechsler, 2014) with a mean score of 100 and a standard deviation of 15. Thus, scores between 90 and 110 are considered to be in the average range of intellectual functioning (Wechsler, 2014).

## Results

As can be seen in Table 1, the data suggest that when administered the KABC-II, Hmong American students scored one standard deviation below the mean on the FCI. Also, the MPI was one standard deviation below the mean and the NVI was nearly one standard deviation below the mean. The sample in this study still had difficulties when cognitive processing was measured by itself (as measured by the MPI) or language was excluded from the assessment all together (as measured by the NVI). Further analysis of the G*c* index indicates that the students involved in this study had lower abstract verbal reasoning and verbal abilities in the English language even though they reported to speak English conversationally and did not need interpretation to complete the tasks they were presented. Also, G*sm* yielded average scores over one standard deviation below the mean. G*lr* was nearly the same, indicating that the sample in this study displayed difficulties in individual learning and memorization related tasks.

**Table 1.** *All Hmong Students' KABC-II Scores*

| | FCI | NVI | MPI | Sequential/G*sm* | Simultaneous G*v* | Planning/G*f* | Learning /G*lr* | Knowledge/G*c* |
|---|---|---|---|---|---|---|---|---|
| Mean | 83 | 86 | 85 | 84 | 93 | 91 | 86 | 75 |
| Median | 82 | 86 | 85 | 85 | 93 | 90 | 85 | 75 |
| Mode | 80 | 90 | 84 | 94 | 97 | 88 | 84 | 69 |
| St Dev | 10 | 15 | 12 | 12 | 15 | 13 | 12 | 10 |
| N | 99 | 65 | 137 | 138 | 138 | 120 | 138 | 100 |

*Note. KABC-II has a mean of 100 and a standard deviation of 15. Scores between 85 and 115 are in the average range.*

In contrast to Hmong American children's scores, Table 2 contains the Caucasian sample's KABC-II scores for both the FCI and MPI where the mean score for the FCI was 98 and for the MPI was 99; commensurate to the absolute average of the assessment itself, which is 100. Participants also obtained scores in the average range across all indexes indicating this samples scores fit the standardized sample that was used in creating the assessment.

**Table 2.** *All Caucasian Students' KABC-II Scores*

| | FCI | NVI | MPI | Sequential/G*sm* | Simultaneous/G*v* | Planning/G*f* | Learning/G*lr* | Knowledge/G*c* |
|---|---|---|---|---|---|---|---|---|
| Mean | 98 | 76 | 99 | 101 | 101 | 99 | 95 | 98 |
| Median | 98 | 92 | 98 | 103 | 101 | 96 | 92 | 97 |
| Mode | 90 | n/a | 90 | 121 | 103 | 90 | 92 | 95 |
| Standard Deviation | 15 | 24 | 15 | 14 | 18 | 15 | 14 | 13 |
| N | 51 | 3 | 51 | 51 | 51 | 45 | 51 | 51 |

*Note. Caucasian KABC-II scores – Ages 5 – 14. Scores have a mean of 100 and a standard deviation of 15. Scores between 85 and 115 are in the Average range.*

Since Tables 1 and 2 combined scores from children ages 5-18, they might have masked scores for children at the lower grades where formal learning was recently introduced to the children. Table 3 indicates the KABC-II scores for children in grades K-3rd are below the average range and are also showing commensuration with a mean FCI of 82, a mean NVI of 84, and a mean MPI of 84. In contrast to these scores, Table 4 contains the scores of the Caucasian sample, K-3rd grades, where scores are significantly better across all areas and, again, obtaining average overall scores at or 3 points away from the mean of 100 with a mean FCI score of 102, a mean NVI score of 97, and a mean MPI score of 103.

**Table 3.** *K-3rd Grade Hmong Students' KABC-II Scores*

| | FCI | NVI | MPI | Sequential/G*sm* | Simultaneous/G*v* | Planning/G*f* | Learning/G*lr* | Knowledge/G*c* |
|---|---|---|---|---|---|---|---|---|
| Mean | 81 | 84 | 83 | 84 | 92 | 92 | 83 | 74 |
| Median | 80 | 83 | 83 | 83 | 93 | 93 | 84 | 73 |
| Mode | 80 | 82 | 79 | 94 | 97 | 88 | 86 | 66 |
| Standard Deviation | 11 | 14 | 12 | 13 | 15 | 12 | 12 | 12 |
| N | 43 | 38 | 62 | 62 | 62 | 44 | 62 | 42 |

*Note: Mean = 100, SD = 15. Scores between 85 and 115 are in the Average range.*

**Table 4.** *K-3rd Grade Caucasian Students' KABC-II Scores*

| | FCI | NVI | MPI | Sequential/G*sm* | Simultaneous G*v* | Planning/G*f* | Learning/G*lr* | Knowledge/G*c* |
|---|---|---|---|---|---|---|---|---|
| Mean | 102 | 97 | 103 | 104 | 104 | 101 | 99 | 101 |
| Median | 106 | 92 | 105 | 109 | 103 | 94 | 97 | 101 |
| Mode | 108 | N/A | 111 | 121 | 109 | 132 | 111 | 95 |
| Standard Deviation | 17 | 24 | 18 | 16 | 17 | 18 | 15 | 13 |
| N | 26 | 3 | 26 | 26 | 26 | 20 | 26 | 26 |

*Note. Mean = 100, SD = 15. Scores between 85 and 115 are in the Average range.*

A further analysis of the data that included only Hmong American children in kindergarten revealed that their scores, on average, fell one standard deviation below the mean or more for the FCI, NVI, and MPI, and across all sub-indices (see Table 5). Conversely, Table 6 provides scores obtained from Caucasian kindergarten students who participated in this study. All scores obtained were in the average range and were over the mean score of 100 with the exception of the NVI, which only had one data point. These scores suggest that Caucasian students are living and learning in ways that affirm the formalized cognitive processes the KABC-II is intended to measure and how it is measuring it.

**Table 5.** *Kindergarten Hmong Students' KABC-II Scores*

| | FCI | NVI | MPI | Sequential/G*sm* | Simultaneous/G*v* | Planning/G*f* | Learning G*lr* | Knowledge G*c* |
|---|---|---|---|---|---|---|---|---|
| Mean | 79 | 79 | 80 | 78 | 85 | n/a | 85 | 72 |
| Median | 77 | 81 | 81 | 75 | 88 | n/a | 84 | 68 |
| Mode | n/a | 81 | 74 | 71 | 97 | n/a | 84 | 68 |
| Standard Deviation | 17 | 12 | 15 | 13 | 17 | n/a | 13 | 16 |
| N | 12 | 12 | 18 | 18 | 18 | n/a | 18 | 12 |

*Note. Mean = 100, SD = 15. Scores between 85 and 115 are in the Average range*.

**Table 6**. *Kindergarten Caucasian Students' KABC-II Scores*

| | FCI | NVI | MPI | Sequential G*sm* | Simultaneous G*v* | Planning G*f* | Learning G*lr* | Knowledge G*c* |
|---|---|---|---|---|---|---|---|---|
| Mean | 107 | 92 | 107 | 112 | 106 | n/a | 102 | 107 |
| Median | 108 | 92 | 108 | 115 | 103 | n/a | 101 | 106 |
| Mode | 108 | n/a | n/a | 115 | n/a | n/a | 92 | 101 |
| Standard Deviation | 17 | n/a | 19 | 8 | 21 | n/a | 19 | 6 |
| N | 6 | 1 | 6 | 6 | 6 | 0 | 6 | 6 |

*Note. Mean = 100, SD = 15. Scores between 85 and 115 are in the Average range.*

Table 7 contains specific scaled scores obtained from the indices of G*v* and G*f* on the KABC-II from the Hmong American population of examinees. Subtests that required real life application, application of pragmatic thinking, and concrete thinking, such as Triangles, Block Counting, and Story Completion, yielded scores less than one point below the mean score. Subtests that required application of categorization, abstract reasoning, and generalization, such as Pattern Reasoning and Conceptual Thinking, were nearly two points or more below the mean. Also, all subtests represented in Table 7 but one, Rover, are included in the NVI indicating these subtests have been deemed most appropriate for students that are culturally and linguistically diverse. All 6 of the subtests in table 7 are included when administering the MPI or the FCI depending on the age of the examinee, as well (Kaufman & Kaufman, 2004).

**Table 7.** *Subtest subscale scores for Visual Spatial/Simultaneous and Fluid Reasoning/Planning Indices – Ages 5-18*

| Subtest | Rover | Triangles | Block Counting | Pattern Reasoning | Conceptual Thinking | Story Completion |
|---|---|---|---|---|---|---|
| Mean | 8.06 | 9.35 | 9.42 | 8.07 | 5.95 | 9.3 |
| Median | 8 | 10 | 10 | 8 | 4.5 | 9.5 |
| Mode | 6 | 10 | 10 | 9 | 1 | 11 |
| Standard Deviation | 2.86 | 3.044 | 3.16 | 2.89 | 4.43 | 2.85 |
| N | 129 | 97 | 83 | 144 | 20 | 128 |

*Note. Scores have a mean of 10 and a standard deviation of 3*.

Table 8 shows data obtained from 46 Hmong American students who were assessed using the WISC-V. The data suggest that Hmong American students, on average, obtain FSIQ scores in the Low range of functioning (standard scores between 70 and 80) and NVI scores in the Below Average range of functioning (standard scores between 80-90) indicating that when language is absent, Hmong American students did better; however, they still struggled and obtained scores over one standard deviation below the mean. Also, when observing both Tables 1 and 8 Hmong American students did the best in the area of G*v*. These subtests require the examinees to use *here and now* thinking to solve immediate problems by observing and replicating tasks, quantitative reasoning, and exercising pragmatic and contextualized approaches to problem solving.

**Table 8.** *Hmong WISC-V scores – Ages 7-14*

| | FSIQ | NVI | Verbal Comp./G*c* | Fluid Reasoning/G*f* | Visual Spatial/G*v* | Working Memory/G*sm* | Processing Speed/G*s* |
|---|---|---|---|---|---|---|---|
| Mean | 78 | 84 | 71 | 88 | 90 | 76 | 87 |
| Median | 79 | 84 | 70 | 88 | 89 | 75 | 87 |
| Mode | 83 | 76 | 78 | 82 | 86 | 74 | 92 |
| Standard Deviation | 8 | 9 | 10 | 10 | 11 | 9 | 14 |
| N | 40 | 45 | 40 | 46 | 46 | 44 | 44 |

*Note. Scores have a mean of 100 and a standard deviation of 15. Scores between 90 and 110 are in the Average range.*

## Discussion and Implications

### Overall Index Scores for Both Samples Ages 5-18

As we expected, there was little difference between the scores across all three indices on the KABC-II for both the Hmong American and Caucasian populations in this study. Students who were suspected of having scores that would be compromised by administering the Full battery to yield a FCI score were administered the Luria based model to obtain a MPI score. As stated by Kaufman and Kaufman (2004), the MPI is recommended for examinees from bilingual backgrounds and those who practice non-mainstream cultures. Much of the Hmong American population in this study fit these two criteria and were administered the MPI, yet, participants gained scores one standard deviation below the mean, on average. For those participants who spoke limited English, the NVI was administered. Again, as stated by Kaufman and Kaufman (2004), this scale is specifically designed for students who are not fluent in English. Although this index yielded the highest overall score of all three, it was still 14 points below the mean, nearly one standard deviation. Furthermore, even those students who reported English as their primary language still obtained scores over one standard deviation below the mean on the FCI index, suggesting that abstract verbal knowledge and general knowledge were areas of most difficulty. Further analysis shows the average KABC-II G*c* score for the Hmong American students in this study was 25 points below the mean score, or almost two standard deviations below the mean. Lastly, as Marshall (1998) and Marshall and DeCapua (2013) state, one significant characteristic of the Hmong American, informal learner is the collective learning style they practice. This is evident as their scores in the areas of independent learning and related abilities, G*sm* and G*lr,* were both one point away from being one standard deviation below the mean.

The Caucasian sample of examinees in this study yielded starkly contrasting scores. Similar to data obtained in previous studies (Dale et al., 2011; Kaufman and Kaufman, 2004; Scheiber and Kaufman, 2015), overall scores show commensuration across all areas and are found to be ±2 points away from the mean of 100 with the exception of the NVI which only had 3 points of data and the G*lr* index that was 5 points below the mean, still higher than all averages obtained by the Hmong American sample.

Scores obtained by Hmong American students seem to be driven more by cultural patterns of teaching and learning rather than just language. These scores also seem to rely on measures that are based on *culture free* processing abilities as well as nonverbal batteries, factors that may give examiners misleading scores and results.

**Kindergarten – 3rd Grade and Early Cognitive Development**

When examined further, the scores from the sample of students, ages 5-9, yield even more concerning information. Peisner-Feinberg, Burchinal, Clifford, Culkin, Howes, Kagen, and Yazejian (2001) and Downer & Pianta (2006) state that children in this age range, K – 3rd grade, are vulnerable academically and cognitively. Cognitive abilities are shaped before students begin formal schooling and during the grades K – 3rd. Experiences before pre-K determine how children cognitively process information and demonstrate these abilities in school and on assessments (Downer & Pianta, 2006; Peisner-Feinberg et al., 2001).

The K-3rd grade sample of Hmong American students in this study obtained scores in the FCI, NVI, and MPI all over 1 standard deviation below the mean. Sub-index scores such as G*sm*, G*lr*, and G*c* were all over 1 standard deviation below the mean; however, G*v* and G*f* were the strongest areas, both only 8 points below the mean. An even further examination of the Kindergarten aged Hmong American students shows that all obtained scores were over 1 standard deviation below the mean, with some over 20 points below. Again, in stark contrast, the Caucasian sample ages 5-9 in this study obtained remarkably higher scores, and in some cases, they scored higher than the mean score of 100. When examined further, the Kindergarten population of Caucasian students yielded scores all in the average range. Data from this study suggest that the K-3rd grade sample of Hmong American children shows difficulty demonstrating formalized cognitive processing abilities as measured by the KABC-II. This does not indicate poor home life or lack of parenting; however, we speculate that this underperformance is a result of the incongruence between how learning and cognition are formed at home from birth to entry into the formalized system of schooling and the design of the intellectual assessments.

## Contextualized and Pragmatic Reasoning Versus Abstract Thinking and Categorization

Flanagan, Ortiz, & Alfonso (2013) suggest that scores on the KABC-II can be interpreted more in depth in terms of linguistic and cultural loading beyond what the KABC-II examiners manual offers. Each subtest of the KABC-II will yield a scaled score derived from the raw score the examinee obtains which will range from 1-19, have a mean of 10, and a standard deviation of 3. Flanagan et al. (2013) offer the use of what they term the Culture-Language Interpretive Matrix to specifically categorize and rate subtests of different assessments based on levels of linguistic demand and cultural loading. Subtests range from Low/Low (indicating the subtest has low linguistic demand and low cultural loading) to High/High (indicating the subtest has high linguistic demand and high cultural loading) (Flanagan et al., 2013). If an examinee presents attributes such as being a non-native language speaker and/or practices a non-mainstream culture, use of the Culture-Language Interpretative Matrix is suggested as a way to determine if scores obtained are a result of low acculturation and assimilation or if they are true indicators of cognitive abilities (Flanagan et al., 2013). If examinees do obtain scores that suggest acculturation and assimilation are factors impacting their performance, the examiner is advised to interpret the scores with caution, as it may not be a true indication of the examinee's intellectual abilities (Flanagan et al., 2013). Examiners determine if assimilation and acculturation are factors by applying scaled scores to the Culture-Language Interpretative Matrix. The higher the level of linguistic demand and cultural loading the subtest has, the lower the predicted scaled scores will be, and vice versa. Higher scaled scores in areas where they are predicted to be low, and lower scaled scores in areas where they are predicted to be high, indicate, according to Flanagan et al. (2013), that language and culture were likely not primary factors in the scaled scores obtained.

If we apply Flanagan et al.'s (2013) Culture-Language Interpretive Matrix to the scores obtained by the Hmong American sample of this study, the results present interesting information. For example, the subtest Rover has a linguistic demand and cultural loading of Moderate/Moderate and requires a *learn by doing* approach, immediate problem-solving application, and lower use of abstract reasoning (Flanagan et al., 2013; Kaufman & Kaufman, 2004). Hmong American participants of this study gained an average scaled score of 8.06 on this subtest. The subtest Pattern Reasoning, which requires more categorization and abstract reasoning (Kaufman & Kaufman, 2004), has a linguistic demand and cultural loading of Low/Low. Hmong American participants of this study obtained an average scaled score of 8.07 on this subtest, virtually identical to those obtained in the Rover subtest indicating that, although Pattern Reasoning had lower linguistic demand and cultural loading than Rover, examinees still performed the same. Conceptual Thinking, which requires participants to apply categorization/classification and abstract reasoning abilities (Kaufman & Kaufman, 2004), has a linguistic demand and cultural loading of Moderate/Moderate, identical to Rover, yet, Hmong

American participants obtained an average scaled score of 5.95 on this subtest, over 1 standard deviation below the mean. The subtest Triangles, which again requires *here and now* immediate problem-solving application and less abstract reasoning (Kaufman & Kaufman, 2004), has a linguistic demand and cultural loading of Low/Low, equal to Pattern Reasoning, and yielded an average scaled score of 9.35. The Subtest Block Counting, which requires less abstract reasoning, has a linguistic demand and cultural loading of Moderate/Low where participants obtained an average scale score of 9.42. Lastly, the subtest Story Completion has a linguistic demand and cultural loading of Moderate/High where participants obtained an average scaled score of 9.3. This subtest, again, is lower in abstract reasoning and categorical thinking demand (Kaufman & Kaufman, 2004).

These score sets are affirmed by the theory that when informal learners, specifically Hmong American students, are asked what doesn't belong in a series of items or are asked to abstractly reason, generalize, and/or categorize (the nature of Conceptual Thinking and Pattern Reasoning), they will likely struggle to give the correct answer; however, they do much better with concrete, contextualized, *here and now*, and low in abstract reasoning demand-based tasks such as Block Counting, Triangles, Rover, and Story Completion.

According to Flanagan et al.'s (2013) Culture-Language Interpretive Matrix, the scores obtained by the population of this study would indicate that language and culture are not likely dominant factors in the examinee's performance, since perceived loading of subtests did not alter scaled scores in the predicted patterns of the Culture-Language Interpretive Matrix. If one considers how the informal learner typically reasons with and processes information; however, the scores obtained by the Hmong American population would absolutely suggest that culture has affected the overall scores. Subtests administered to this group requiring higher abstract thinking, categorization, and generalization, presented lower-scaled scores, despite their presumed lower levels of linguistic demand and cultural loading. Subtests requiring the application of more contextualized and concrete thinking yielded higher-scaled scores despite their presumed higher levels of linguistic demand and cultural loading. Although the Culture-Language Interpretive Matrix for this population of students did not predict these results, they are directly supported and indirectly predicted by research and theory (Denny, 1991; Greenfield, 1998; Hvitfeldt, 1986; Luria, 1973; Marshall, 1998; Marshall & DeCapua, 2013).

In summary, tools such as the Culture-Language Interpretive Matrix may be inadequate when testing and interpreting scores of the Hmong American population and may result in overall interpretations and conclusions of those scores that misrepresent the true intellectual and processing abilities of the informal learner.

**Limitations of the Study**

This study is one of the first of its kind to call to question the reliability and validity of the mainstream, formalized methods of education and intellectual assessment. Therefore, there are some limitations that must be considered when interpreting the results. First, data used for this study were based on convenient samples from a few charter schools. Therefore, the results of this study must be interpreted cautiously. Next, the unequal sample sizes of the Hmong American and Caucasian students might have skewed the results despite a clear evidence of how Caucasian students performed on the KABC-II (Dale et al., 2011; Kaufman & Kaufman, 2004; Scheiber & Kaufman, 2011).

Third, all data from each assessment could not be retrieved as, over time, original testing documents are shredded and compressed into electronic format for confidentiality reasons. In this transition, critical data from the assessment is lost, such as specific subtest scores and raw scores. As such, all overall scores and index scores could be obtained; however, not all subtest scores were retrievable, limiting data reported in Table 7.

Lastly, socioeconomic status of the students' families was not collected since the data collection was part of the overall intellectual assessment to determine for special education services and family data were protected by law. Given what is known about the influence of family socioeconomic status on students' achievement (Evans, 2004; Lareau, 2011), future studies need to explore the relationships between family SES and learning and reasoning styles of Hmong American children. Similarly, other factors such as ELL, immigration status, and acculturation level should be included in future studies.

## Implications for Further Research

As stated by Luria, (1973), McVee et al. (2005), and Naglieri et al. (2012), culture plays a direct role in cognition. The informal culture of Hmong Americans likely has played a role in forming different mental schemata and ways of reasoning and learning that lack congruency with the mainstream, formalized methods of education and intellectual assessment. The two instruments used in this study, the KABC-II and the WISC-V are mainstream, prominent tools that have gained widespread respect and use in the field of clinical and school psychology (Drozdick et al., 2012; Fletcher-Janez, 2009; Kaufman et al., 2006; Singer et al., 2012). When used on Hmong American students, however, both result in scores in the Below Average range of intelligence. Hmong American students are not, by nature, Below Average intellectually; however, until culturally appropriate assessment tools are created to measure intelligence and cognitive processing, Below Average scores will be used to determine these students' paths forward when assessed for alternative education services. Also, Hmong American students in this study who were referred for assessment may not have been experiencing poor academics due to cognitive difficulties. They may have been experiencing a culturally influenced academic delay, or, a significant academic delay or difficulty attributed to cultural patterns of living and learning that do not predicate the educational system by which one is academically taught and measured. This would indicate a need not just for new assessment tools, but also new and more relevant curriculum for students matching the informal learner profile.

Recognition that current intellectual assessments measure formal intelligence and cognitive processing may stimulate and promote research with larger sample sizes and better study designs aimed at measuring and developing Informal Cognitive Processing assessments and determining how they correlate with future academic success and life performance. In conjunction with this recognition, re-norming and re-standardization of current assessments will also be necessary. Only by doing this will the scores obtained be a true indication of Hmong American student's intellectual and processing abilities, as opposed to a formalized, Western intellectual score lacking cultural significance.

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