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EVALUATION of THEORETICAL FRAMEWORK of INTELLIGENCE TESTS

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ABSTRACT

Intelligence tests are often used in diagnostic psychological assessments in a variety of fields. The importance of intelligence tests in terms of education emerges at the point of determining whether students can benefit from the education at school. Therefore, intelligence tests have gained importance in terms of making instructional adaptations suitable for students' cognitive performance. Additionally, in this process, one must first pay attention to whether the measurement instrument used is valid and reliable. Another crucial point is what intelligence tests actually measure. Examining the theoretical foundations of the tests and understanding the cognitive functions that contemporary intelligence tests aim to measure will ensure effective and accurate interpretation of intelligence test results. There are many intelligence tests in the literature. Intelligence tests have been developed on different theoretical frameworks. Researchers have examined intelligence from various perspectives. Among these perspectives, two significant approaches that form the theoretical basis for many contemporary intelligence tests and have gained scientific acceptance are the factor-analytic and information-processing perspectives. The fundamental theories that explain intelligence from a factor-analytic perspective serve as the foundation for many intelligence tests today. Among these theories, the Cattell-Horn-Carroll (CHC) Theory is the most widely accepted. Each intelligence test based on these different perspectives also has a distinct structure in terms of content and response format. Intelligence tests include interpretations aimed at understanding cognitive abilities rather than obtaining a score-based result and classifying individuals according to these numerical values. In this respect, understanding the theoretical frameworks and psychometric properties of intelligence tests is important in the process of interpreting the test results. The aim of this study is to analyze the theoretical structure of intelligence tests and to compare the relationship between intelligence theories and intelligence tests. As a result of the study, it was determined that factor analytic theories are the most frequently used approach in current intelligence tests.

Keywords: Intelligence, intelligence theory, intelligence scale.

INTRODUCTION

Interest in intelligence tests and the conducted studies have began to explore the differences among students and evaluate which students can benefit from formal education and which cannot (Sattler, 2018). Over time, intelligence tests, being used for various purposes, have also been more widely utilized in our education system. Both group tests and individual tests are beneficial for identifying students and providing them with opportunities suitable for their cognitive levels in their education. Additionally, during this process, a crucial consideration is whether the measurement tool used is valid and reliable. Another important aspect is what intelligence tests measure. Examining the theoretical foundations of tests and knowing what cognitive functions contemporary intelligence tests aim to measure will facilitate the effective and accurate interpretation of intelligence test results. Before examining intelligence theories and intelligence tests based on these theories, definitions of intelligence and scientific studies related to measuring intelligence have been investigated.

Definitions of Intelligence and the Historical Process of Measuring Intelligence

The interest in intelligence and the measurement of intelligence follows a broad historical process from Ancient Greece to the present day. According to Greek philosophers, such as Plato, intelligence is regarded as the love of learning and the pursuit of truth. Aristotle, on the other hand, considered it as the ability to deduce conclusions based on relationships between events. A more detailed assessment was provided by the English philosopher Thomas Hobbes in the 17th century; superior intelligence should encompass rapid awareness, the ability to perceive similarities among different things, and differences among the same things (Mackintosh, 2011). This perspective could still pursue in modern intelligence tests.

These initial definitions from Ancient Greece laid the ground for modern scholarly perspectives. The first scientific endeavors began in the late 19th century with Sir Francis Galton, who had been influenced by Charles Darwin. In 1888, Galton established an Anthropometric Laboratory to understand intelligence. He recorded and assessed numerous variables ranging from individuals' physical traits to their behavioral responses. Galton never claimed that his tests directly measured intelligence, stating that he aimed to comprehend individual differences in intelligence well (Wasserman, 2018). Efforts to measure intelligence initiated by Galton spurred numerous studies in Europe and America. James McKeen Cattell, who was influenced by Galton and his student, brought Galton's ideas from England to America and coined the term "intelligence test" for the first time. While Galton and J. M. Cattell's assessments of intelligence included basic and narrow sensory and motor measurements, in 1911, Binet emphasized the need to measure more complex mental abilities in intelligence testing (Wasserman, 2018). The Binet-Simon Intelligence Scale, developed by Binet, was the first intelligence test used in experimental and practical applications (Kamphaus et al., 2018). The development of this test paved the way for the creation of many other intelligence tests. In subsequent years, the test was revised and expanded by Terman. Terman's work could also be considered as the initiation of intelligence test applications in schools (Wasserman, 2018). While Binet was developing his scale in France, Charles Spearman in England was attempting to prove Galton's hypothesis regarding the relationship between sensory acuity and intelligence. During this time, Spearman focused on the correlation methods discovered by Galton and Karl Pearson, and he developed the method of factor analysis (Urbina, 2014).

With the onset of the First World War, intelligence tests began to be used in America to select personnel for military units. Yerkes and his colleagues developed two tests (Alpha and Beta Army Tests) to determine the intelligence levels of soldiers. The Alpha Test included verbal intelligence questions, while the later developed Beta Test consisted only of non-verbal questions and was designed to assess soldiers with lower English proficiency.

In the second half of the 20th century, the Wechsler Intelligence Test, which is still widely used today, was developed by David Wechsler. Wechsler defines intelligence as an individual's holistic capacity for purposeful behavior, logical thinking, and effective adaptation to their environment. He uses the term "holistic" because, according to Wechsler, intelligence consists of a combination of abilities that do not entirely differentiate but rather differentiate qualitatively (Cohen & Swerdlik, 2010). These qualitatively differentiated ability areas form verbal and performance scores. The Wechsler Intelligence Test includes separate forms for adults, children, and preschool children.

During the same period as Wechsler, Swiss psychologist Jean Piaget conducted studies in developmental psychology. Piaget examined cognitive development under four main stages: Sensorimotor (0-2 years), Preoperational (2-6 years), Concrete Operational (7-12 years), and Formal Operational (12 years and beyond). In the sensorimotor stage, individuals attempt to perceive their environment through their sensory organs. In the preoperational stage, they can understand what they see and grasp static objects qualitatively. During the concrete operational stage, they can evaluate problems from various angles and perceive relationships. The formal operational stage represents the final period of cognitive development. Individuals develop the ability for abstract thinking during this stage, can cope with unfamiliar situations, and can learn new situations inquisitively. Piaget states that individuals complete these periods successively but at different rates and ages (Cohen & Swerdlik, 2010).

According to Piaget, intelligence could be understood as the biological adaptation to the external world. Additionally, the cognitive development process does not solely rely on maturity or learning. Unlike theorists with a psychometric perspective, Piaget does not focus on individual differences. For him, every individual achieves their cognitive development by following the stages he defined, regardless of the speed of development (Sternberg, Kaufman & Grigorenko, 2008).

Factor Analytic Theories

Factor analysis is a data summarization and structure improvement technique that can transform large datasets into smaller components (Pallant, 2001). In simple terms, factor analysis involves breaking down a structure composed of multiple variables into subcategories and creating subgroups based on the similar characteristics exhibited by these variables. In essence, it allows the grouping of variables that share common features. In the realm of intelligence theories, factor analysis has been used by theorists to determine correlations between various abilities that constitute or influence intelligence and can be measured through tests. Through a factor analytic perspective, several fundamental theories explaining intelligence have emerged: Spearman's Two-Factor Theory, Thurstone's Primary Mental Abilities Theory, and the Cattell-Horn-Carroll (CHC) Theory.

Spearman's Two-Factor Theory

British psychologist Charles Spearman discovered that different measures of abilities were interrelated to varying degrees. He explained this relationship through his Two-Factor Theory (Spearman, 1927). The Two-Factor Theory proposes that test scores can be explained by two types of abilities: general ability and specific ability. In the theory, the general mental ability factor is denoted as "g", and the specific ability factor is denoted as "s" (Figure 1). While the general ability (g) influences all test scores, each specific ability (s) only affects one specific test. Each ability area is composed of these two factors. According to Spearman, when measuring an individual's intelligence, it is necessary to measure the "g" factor that plays a role in all mental processes. Spearman believed that intelligence couldn't be precisely defined. He described intelligence as "conscious adaptation to new situations," "capacity for learning," and "power of combination" (Spearman, 1927).

Spearman interprets the g factor based on several psychological foundations. While explaining the concept of intelligence with the foundation of g, he also refers to the concepts of "attention or effort" and "mental energy." According to Spearman, the psychological concept that best explains g after intelligence is the power of attention. As "attention or effort," g expresses an individual's desire or capacity to adapt their thoughts to new situations. The Mental Energy hypothesis aims to interpret g based on experimental evidence. In this hypothesis, the g factor is interpreted as a type of general electrochemical mental energy that the brain can utilize during problem-solving. Mental energy is also associated with the ability of an individual to contemplate their experiences, make observations, and draw inferences. In this context, the concept of energy is seen as the transfer of something to another (Spearman, 1927).

The specific ability factor "s," on the other hand, can be regarded as a complementary factor that only exists in a single mental activity, completing the general intelligence. The g factor better predicts general mental capacity compared to the s factor. Additionally, all ability areas have some degree of g factor presence. However, in some dominant ability areas, the g factor can be obstructed (Spearman, 1927).

Spearman and his students introduced the concept of the "group factor," which they mentioned includes some intermediate-level ability groups. This factor is neither as general as g nor as specific as s. The group factor consists of linguistic, mechanical, and arithmetic abilities.

Thurstone's Primary Mental Ability Theory

Thurstone, between 1938 and 1947, researched Spearman's general and specific mental ability factors and proposed a new theory (Horn & Blankson, 2012). In this theory, which claims that intelligence consists of eight primary mental ability domains, Thurstone identified the following primary ability areas: Verbal Comprehension (V), Word Fluency (W), Number Ability (N), Memory (M), Visualization or Spatial Thinking (S), Perceptual Speed (P), Deduction (I), and Inductive Reasoning (J) (Wasserman, 2018). Each primary ability area also includes various sub-ability areas. For instance, the Number Ability domain includes three sub-ability areas: estimation, mathematical operations, and mathematical reasoning. Thurstone describes approximately 80 cognitive abilities within these eight primary mental ability domains.

Thurstone (1938) doesn't deny the existence of the g factor, but he emphasizes abilities that he labels as primary mental abilities. He acknowledges that not all tests can be generalized to these abilities, nor are they specific to each test. Due to his intensive work on intelligence tests, Thurstone developed a comprehensive battery comprising more than 50 cognitive ability tests that can be used across different age groups. Many of these tests have been utilized in various research contexts. However, there isn't a clinical measurement tool based on Thurstone's primary mental abilities battery (Schneider & Flanagan, 2015).

Cattell- Horn- Carroll (CHC) Theory

The Cattell-Horn-Carroll (CHC) Theory possesses the most robust model for empirically classifying cognitive abilities (Kaufman, 2009; McGrew, 2005). The validity of the model has been assessed multiple times, and in their recent study, Caemmerer, Keith, and Reynolds (2020) once again reaffirmed its effectiveness through comparative analyses involving 6 intelligence tests and 66 subtests. The abundance and replication of validity studies pertaining to the theory support the applicability and interpretability of intelligence tests based on the CHC theory. As a result, the CHC theory serves as the foundational framework for the development of numerous contemporary intelligence tests in use today.

The theorists who contributed to the foundation of the CHC Theory are Raymond Cattell, John Horn, and John Carroll (Schneider & McGrew, 2018). The CHC Theory is considered not merely an independently developed theory but a refined and integrated form of the intelligence theories put forth by these mentioned theorists. Fundamentally, the theory is developed as a synthesis of Carroll's Three-Stratum Theory of Cognitive Abilities and Cattell-Horn's Gf-Gc Theory (McGrew, 1997; Schneider & McGrew, 2018). Therefore, it is deemed important to first examine the factor-analytic theories that paved the way for the CHC Theory (Figure 1). This is significant not only for understanding the CHC Theory but also for interpreting intelligence tests developed according to the CHC Theory.

Raymond B. Cattell (1943) proposed the gf -gc Theory, which posits that cognitive abilities are composed of two general factors: crystallized intelligence (gc) and fluid intelligence (gf). Crystallized intelligence encompasses skills and knowledge acquired through formal or informal means influenced by culture (e.g., vocabulary). The abilities that constitute fluid intelligence are generally non-verbal, independent of culture, and specific education (Cohen & Swerdlik, 2010).

Cattell's model was further organized and developed by Horn under Cattell's supervision (Horn and Cattell, 1966). This organized model is referred to as the Cattell-Horn Gf-Gc Theory (Schneider & Mcgrew, 2012). In addition to Gf and Gc cognitive abilities present in Cattell's theory, Horn added visual processing (Gv), auditory processing (Ga), quantitative knowledge (Gq), processing speed (Gs), reading and writing (Grw), short-term memory (Gsm), long-term memory (Glm), and long-term storage and retrieval (Glr) ability domains to the theory (Horn & Blankson, 2012). According to Horn, some of these abilities are referred to as vulnerable abilities, while others are considered as maintained abilities. Vulnerable abilities denote skills that can be lost with age. These include visual processing and processing speed. Maintained abilities, on the other hand, represent skills that do not decrease with age, such as quantitative knowledge (Gq). Some of the intelligence tests developed based on this theory include the Woodcock–Johnson-Revised Intelligence Test (WJ-R) (Woodcock, 1990) and the Kaufman Adult Intelligence Test (KAIT) (Kaufman & Kaufman, 1993).

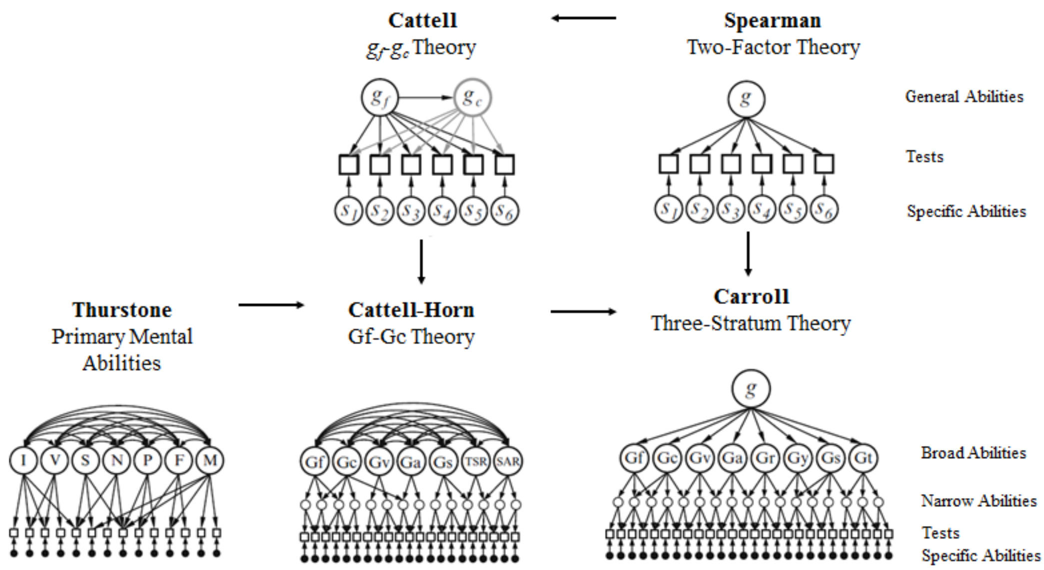

Figure 1. Precursor Theories of the CHC Theory (Schneider & Flanagan, 2015)

Carroll (1996) further examined intelligence using a multidimensional factorial structure after Horn, developing the Three-Stratum Theory of Cognitive Abilities. In Carroll's theory, cognitive abilities consist of three strata. The top stratum (Stratum III-general) includes what is considered equivalent to Spearman's general intelligence factor, g (3G). The middle stratum (Stratum II-broad) comprises eight broad ability domains: fluid intelligence (2F or Gf), crystallized intelligence (2C or Gc), general memory and learning (Gy), visual perception (Gv), auditory perception (Ga), retrieval ability (Gr), cognitive speed (Gs), and processing speed (Gt). The lowest stratum (Stratum I-narrow) encompasses numerous specific ability domains that contribute to the formation of the broad ability domains in Stratum II. For instance, processing speed (2T) consists of five specific mental abilities: simple reaction time (R1), choice reaction time (R2), semantic processing speed (R4), mental comparison speed (R7) (Carroll, 1996). According to the theory, the broad ability domains have varying levels of association with g. For example, fluid intelligence (2F) has a higher correlation with g compared to processing speed. The most significant and distinct difference between Carroll's Three-Stratum Theory of Cognitive Abilities and the Cattell-Horn Gf-Gc Theory is that in the former, the g factor is considered the most fundamental factor within the hierarchical structure of cognitive abilities (Ortiz, 2015). A intelligence scale based on Carroll's Three-Stratum Theory of Cognitive Abilities has not been developed (Esters & Ittenbach, 1999).

As mentioned before, the CHC Theory is formed by synthesizing Carroll's Three-Stratum Theory of Cognitive Abilities and the Cattell-Horn Gf-Gc Theory. In this theory, abilities have a hierarchical structure. In other words, some abilities have broader coverage than others (Figure 2). At the bottom layer of the hierarchy, specific abilities are located. Specific abilities are associated with specific tasks such as distinguishing whether two lines are parallel or intersecting. Specific abilities are the only ability domain directly measured. Other abilities (broad, narrow, and general abilities) are theoretical constructs derived from the observed relationships among specific abilities (Schneider & McGrew, 2018). Narrow abilities are situated hierarchically above specific abilities and are highly correlated with them. For instance, repeating a sentence is highly correlated with repeating a word. Broad abilities are clusters that encompass specific narrow abilities. Broad abilities are highly related to the specific narrow abilities they encompass based on relationships among other broad abilities. For example, within broad abilities, working memory capacity (Gwm), auditory short-term storage, visual short-term storage, and attention control are included as narrow abilities, and these specific abilities have a stronger correlation with these broad abilities compared to other abilities (Schneider & McGrew, 2018).

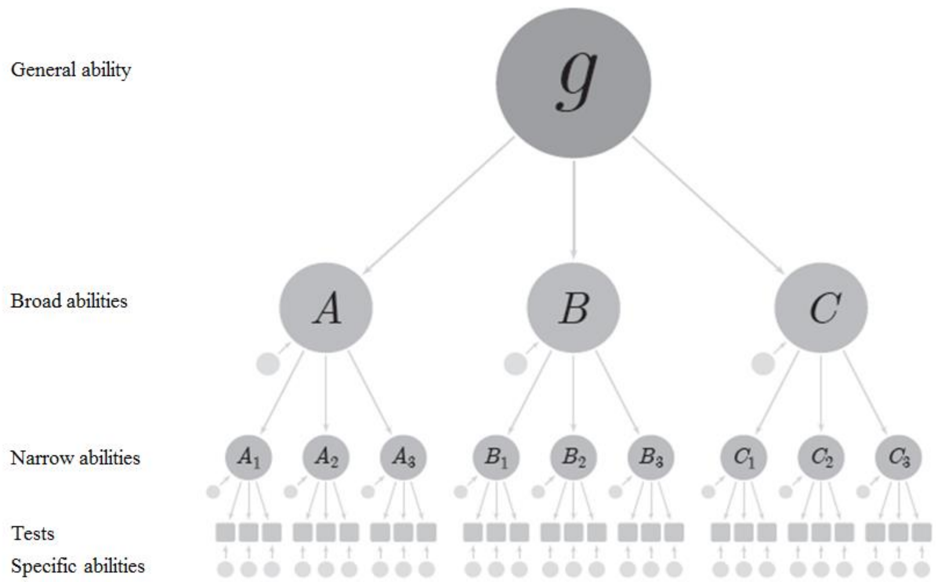

Figure 2. CHC Theory Hierarchical Structure (Schneider & McGrew, 2018)

While each of the intelligence theories based on the factor analytic approach has their distinct factorial structures, these theories also share some common characteristics. The similar cognitive abilities possessed by theories based on the factor analytic approach can be observed in Table 1.

Table 1. Similar Characteristics in Intelligence Theories Based on the Factor Analytic Approach (Schneider & Flanagan, 2015)

Thurstone Primary Mental Abilities Theory	Cattell-Horn Gf-Gc Theory	Carroll Three-Stratum Theory	CHC Theory
Verbal	Cultural knowledge	Crystallized intelligence	Comprehension knowledge
Reasoning	Fluid intelligence	Fluid intelligence	Fluid reasoning
Perceptual speed	Cognitive speed	Broad cognitive speediness	Processing speed
-	Correct desicion speed	Reaction time decision speed	Reaction and decision speed
Word fluency	-	Broad retrieval ability	Retrieval fluency
Memory	Storage and retrieval	General memory and learning	Learning efficiency
-	-	-	Short-term memory
Space	Visualization and spatial orientation	Broad visual perception	Visual processing
-	Listening and hearing	Broad auditory perception	Auditory processing
Number	-	-	Quantitative knowledge

When comparing the CHC theory with other factor analytic theories, it can be said that besides the similar cognitive abilities, these abilities are expressed or grouped in different ways. For example, Learning Ability and Short-Term Memory are considered as separate abilities in the CHC theory, while in Carroll's and Cattell-Horn's theories, they are evaluated under the same ability factor (memory) (Schneider & Flanagan, 2015). The main difference between the CHC theory and other factor analytic theories is that, while the CHC theory accepts the general intelligence factor (g), it is believed that g would not be useful in psychoeducational assessments. McGrew notes that g has very little relevance in evaluations (cross-battery assessment) and interpretations across different intelligence tests (Cohen & Swerdlik, 2010).

The hierarchical structure presented by the CHC theory forms the theoretical basis for many individually administered intelligence tests today (Kaufman et al., 2009; Keith and Reynolds, 2010). The first among the individually administered intelligence tests based on the CHC theory is the Woodcock-Johnson III (WJ-III) Cognitive Abilities Test. The initial version of the test, Woodcock-Johnson-R, was developed based on the Cattell-Horn Gf-Gc Theory. Contemporary intelligence tests developed according to the CHC theory and other intelligence theories are listed in Table 2.

Table 2. The Theoretical Foundations of Contemporary Intelligence Tests

Intelligence Tests	CHC	PASS	Luria
The Woodcock–Johnson III, WJ-III (Woodcock, McGrew, & Mather, 2001).	+		
Wechslers Intelligence Test, WISC-V (Wechsler,2003)	+		
The Kaufman Assessment Battery for Children-Second Edition and KABC-II (Kaufman & Kaufman, 2004)	+		+
The Differential Ability Scales-DAS-II (Elliott, 2007)	+		
The Cognitive Assessment System-CASII (Naglieri, Das & Goldstein, 2014)		+	
The Reynolds Intellectual Assessment Scales-RIAS II (Reynolds & Kamphaus, 2015)	+		
The NEPSY-II (Korkman, Kirk & Kemp, 2007)			+
Stanford-Binet Intelligence Scale 5th Edition, SB 5 (Roid, 2003)	+		
Anadolu Sak Intelligence Scale -ASIS (Sak et.al., 2016)	+		+

Cognitive Processing Theories

Cognitive processing theories can be considered as theories that attempt to explain learning and behaviors with mental structures. They were first explored by cognitive psychology experts in the 1960s, and numerous process theories have been developed in the last half century (Dehn, 2006). The cognitive processing theories that appear most frequently in intelligence tests are Luria's Neuropsychological Theory and the PASS Theory (Princiotta & Goldstein, 2015).

Luria's Neuropsychological Theory

The Russian neuropsychologist Alexander Luria examined the organization and processing process of the brain by dividing it into three functional units (Dehn, 2006). These units are listed in Table 3.

Table 3. Luria's Information Processing Processes

	I. Functional Unit	II. Functional Unit	III. Functional Unit
Processes:	Attention	Successive and Simultaneous	Planning
Area:	Brain-stem	Occipital, Pariatel ve Temporal lobes	Frontal lobes

First Functional unit is the initial step of the information processing process, involving arousal and attention. II. Functional unit encompasses consecutive and simultaneous processing processes taking place in the occipital, parietal, and temporal lobes of the brain. In successive processing, each piece of information is processed sequentially. This means that information is processed in fragments, one after the other. Remembering phone numbers or syllabifying newly learned words can be typical examples of consecutive processing for acquiring information. Simultaneous processing involves the processing of information at the same time. Simultaneous processing is the opposite of consecutive processing. Cohen and Swerdlik (2010) indicate that simultaneous processing can also be referred to as "synthesis." In this process, units of information are obtained simultaneously and synthesized as a whole in one go. Reading maps can serve as an example of simultaneous processing. III. The functional unit involves executive functions, including planning. Planning is a crucial information processing process highlighted in effective problem-solving skills (Dehn, 2006).

Luria interprets all these functional units and processes as parts of an interconnected system. For instance, planning in the III. Functional unit is influenced by the attention process in the I. unit. When an individual is adequately aroused and appropriately directs their attention, they can utilize the processes in the II. and III. Functional units (Das, 2003). According to Kaufman (1993), each factorial unit of Luria actually corresponds to the CHC theory. For example, consecutive processing aligns with short-term memory (in CHC); simultaneous processing matches visual processing (in CHC); planning correlates with fluid intelligence (in CHC). However, crystallized intelligence present in the CHC theory does not find a place within Luria's processes.

One of the IQ tests developed based on Luria's model is the KABC II test. The KABC II test is also developed based on the CHC theory. Therefore, the test provides an opportunity for evaluation from both the perspective of Luria's model and the CHC theory. In the test, the cognitive abilities present in the CHC theory and the information processing processes corresponding to these abilities in Luria's theory are as follows: spatial abilities (simultaneous processing in Luria), fluid reasoning (planning in Luria), long-term memory (attention-learning in Luria), and short-term memory (consecutive processing in Luria) (Keith & Reynolds, 2010). Although structurally similar, the interpretation and application of the models differ. In Luria's model, the Mental Processing Index (MPI) is calculated for overall scores, while in the CHC theory, the Fluid-Crystallized Index (FCI) is used (Dehn, 2006).

PASS Theory

The PASS Theory was developed by Das and Naglieri in the early 1970s, based on Luria's three functional units. The name of the theory is derived from the initials of the words planning, attention, simultaneous, and successive. PASS provides an alternative perspective to the traditional understanding of testing and highlights the possibility of assessing cognitive processes (Naglieri, Das & Goldstein, 2012).

In this model, planning involves developing strategies for problem-solving; attention entails acquiring information; and simultaneous and consecutive processes are seen as types of information processing. Because the PASS theory is developed based on Luria's neuropsychological theory, the cognitive processes focused on by the two theories also bear resemblance. The cognitive processes encompassing information processing in Luria's neuropsychological theory are represented in the PASS theory by four processes (planning, attention, simultaneous processing, and consecutive processing).

Naglieri and Das's (1997) first test developed according to the PASS theory is the Cognitive Assessment System (CAS). CAS consists of thirteen subtests, with three for planning, attention, and simultaneous processing processes, and four for consecutive processing process. The primary applications of CAS can vary depending on the specific purpose. It can be used as an intelligence test for identifying strong or weak functions in learning and diagnosing learning difficulties, attention deficits, intellectual disabilities, or giftedness.

The PASS theory differentiates from the CHC theory in its focus on the distinction between simultaneous processing and consecutive processing processes. According to Schneider and McGrew (2018), this distinction is not explicitly present in the CHC theory, and the PASS theory contributes to the CHC theory in this regard. In the PASS theory, the terms simultaneous and consecutive processing do not represent cognitive abilities; they are considered as descriptive attributes of abilities (Schneider & Newman, 2015). For instance, two abilities together can explain simultaneous processing. From the perspective of the CHC theory, sensory abilities such as olfactory perception, auditory ability, tactile ability, and kinesthetic ability are associated with simultaneous processing. Short-term memory, fluid reasoning, and processing speed abilities are generally linked to the consecutive processing process.

CONCLUSION and DISCUSSION

This study has examined intelligence theories and the contemporary intelligence tests based on these theories in a comparative manner. Different approaches to the concept of intelligence have evolved as a result of efforts to understand intelligence. When considered within the historical context, intelligence test development, which began with factor analytic approaches, took on a different dimension with intelligence theories based on the information processing perspective put forth in the 1960s.

The fundamental theories that explain intelligence through a factor analytic perspective form the basis for many modern intelligence tests. Among these theories, the most widely accepted one is the Cattell-Horn-Carroll (CHC) Theory of Intelligence. The CHC theory of intelligence is based on the psychometric classification of cognitive abilities and is strongly supported by its robust theoretical structure in experimental studies (Kaufman, 2009; Newton & McGrew, 2010). The theory emerges from the integration and development of two previously established fundamental factor analytic intelligence theories. Today, the theoretical foundation of many newly developed or revised intelligence tests is based on the CHC theory. While the CHC theory has become quite popular among researchers working on intelligence tests, there are also criticisms related to the theory. One of the most significant criticisms is that the theory does not focus on the general intelligence factor, or g (Ortiz, 2015). The primary rationale for this orientation is that broad abilities predict academic skills better than g does (Keith & Reynolds, 2010). On the other hand, whether g has a direct impact on performance or its indirect effect on broad and narrow abilities is still a widely debated topic today (Schneider & McGrew, 2018).

Developed as an alternative to factor-analytic approaches to intelligence theories, information processing theories contribute to the understanding and assessment of intelligence from a neuropsychological perspective. While some abilities in factor-analytic theories overlap with the cognitive processes present in information processing-based intelligence theories, information processing theories emphasize a distinction between two fundamental cognitive processing processes: consecutive and simultaneous. (Schneider & Nerman, 2015).

Generally, it's not possible to claim that a single intelligence theory provides the best explanation or that a single intelligence test offers the best assessment. Each intelligence theory contributes to the understanding of cognitive structure and the educational use of intelligence tests. Alongside the shared characteristics of intelligence theories and tests, there are also distinct features. Therefore, being aware of these features and identifying appropriate measurement tools tailored to the purpose, or utilizing alternative measurement tools together, will enable reliable assessments to be conducted.

ETHICAL TEXT

In this research, adherence to journal writing guidelines, publication principles, research and publication ethics, as well as journal ethical standards, has been maintained. The author hold the responsibility for any potential violations concerning the content of the article.

Author(s) Contribution Rate: The author's contribution rate is 100%.

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