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A Survey on the Theories of Intelligence: Implications for Gifted Identification and Education in the Philippines

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A B S T R A C T
This paper critically examines the evolving conceptualization of intelligence, tracing its roots from ancient philosophical discussions to modern psychometric and process-oriented theories. It delves into foundational models like Spearman's g, Cattell and Horn's Gf-Gc model, Thurstone's Primary Mental Abilities, and their synthesis in the Cattell-Horn-Carroll theory. Additionally, it explores alternative perspectives such as Guilford's Structure of Intellect, the PASS theory, Gardner's Multiple Intelligences, and Sternberg's Triarchic Theory. The discussion highlights the strengths and critiques of each framework, emphasizing that intelligence is a multifaceted construct, not a singular entity. Crucially, the paper evaluates the educational implications of these theories for gifted identification and education, particularly within the Philippine context. It argues for moving beyond traditional, often inequitable, identification methods towards comprehensive, multi-indicator approaches and advocates for differentiated, tailored educational strategies that foster diverse talents. The aim is to inform more equitable and effective practices in nurturing gifted individuals.

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INTRODUCTION

Conceptualization of Intelligence

The history of defining intelligence is deeply rooted in various philosophical and psychological perspectives, predominantly focusing on the ability to implement goal-directed adaptive behaviors (Hunt, 2001).The conceptualization of intelligence, a cornerstone of human inquiry, has been a subject of profound philosophical debate stretching back to antiquity, long before the advent of psychological and psychometric theories (Castán et al., 2021; Hunt, 2001). Philosophers and theologians in the Western tradition initially pondered intelligence as a fundamental aspect of the human soul, often distinguishing humanity from other species through this capacity (Carson, 2015). This early philosophical scrutiny laid the groundwork for a continuously evolving understanding of what it means to be intelligent.

Ancient Greek philosophers offered some of the earliest insights into the nature of intellect. Plato, for instance, conceptualized individual intelligence metaphorically as blocks of wax, positing that variations in their size, hardness, moistness, and purity could account for differing intellectual capacities. Deficits, in this view, arose from blocks that were either too hard, too soft, or impure (Cianciolo & Sternberg, 2004). Aristotle, in contrast to Plato's mind-body separation, viewed the mind as intricately linked with bodily experience, functioning as an interactive element rather than a distinct entity (Rashid, 2024). His work further suggested that knowledge itself is a product of the human mind, with Platonic thought also focusing on the pursuit of "true knowledge" (Drigas & Pappas, 2017). Aristotle's psychological hylomorphism emphasized the reciprocal interdependence of the soul and body, considering them inseparable aspects of a living being (Jori, 2019).

Moving into the medieval period, figures like Thomas Aquinas built upon these foundations. Aquinas believed that intelligent individuals possessed a more complete and universal grasp of comprehension skills. However, he maintained that even the most intelligent human mind could not approach the boundless omniscience attributed to God (Cianciolo & Sternberg, 2004). The conceptualization of intelligence continued to attract significant attention in the West, particularly from the eighteenth century onwards, coinciding with a growing curiosity about human differences and the emergence of scientific methodologies (Carson, 2015). Immanuel Kant, an influential philosopher of this era, posited the existence of different kinds or facets of intelligence, acknowledging that individuals inherently varied in the degree to which they possessed these distinct intellectual attributes (Cianciolo & Sternberg, 2004).

These philosophical explorations, though pre-dating modern psychology, significantly foreshadowed the intensive research into intelligence that would characterize the twentieth century (Cianciolo & Sternberg, 2004). Philosophers have continuously emphasized that intelligence involves goal-directed adaptive behavior, and their implicit "folk theories" often reflect a broader understanding of intelligent conduct that extends beyond the confines of standardized testing situations (Cianciolo & Sternberg, 2004; Hunt, 2001). An epistemological perspective on intelligence, stemming from philosophical inquiry, centers on

knowledge acquisition—how intelligence develops through the construction of thinking processes and knowledge structures (Cianciolo & Sternberg, 2004). Furthermore, philosophical discourse is crucial not only for understanding the fundamental nature of intelligence but also for exploring the motivations behind its study, its inherent limitations, and the ethical and normative constraints that should guide its pursuit (Quist, 2022). The historical evolution of these philosophical viewpoints illustrates how the definition of intelligence has continuously shifted in response to new schools of thought, scientific advancements, and a deepening understanding of the world (Castán et al., 2021).

However, modern conceptualization of intelligence has shifted towards more empirical and quantifiable approaches, moving beyond purely philosophical musings to incorporate psychometric and cognitive science perspectives (Castán et al., 2021). Psychological theories, emerging in the late 19th and early 20th centuries, began to operationalize intelligence through measurable constructs, often diverging from the ancient philosophical approaches that did not define intelligence in a way that could be readily tested (Cianciolo & Sternberg, 2004; Sritriratanarak & Garcia, 2023). Hence, this paper will focus on examining prominent psychological theories of intelligence and their implications for identifying and educating gifted individuals, with a particular emphasis on the Philippine context.

METHODOLOGY

This paper employs a systematic literature review to critically discuss the conceptualization of intelligence and its educational implications for gifted identification and education, with a particular focus on the philosophical underpinnings and prominent psychological theories. The review aims to synthesize existing research, identify key theoretical advancements, and analyze their practical applications and critiques within the field. The synthesis of the literature was performed thematically, organizing the discussion around the key ideas, importance, and critiques of each intelligence theory. This approach allowed for a comparative analysis of different conceptualizations of intelligence, highlighting their unique contributions and limitations. The implications for gifted identification and education were drawn directly from the analysis of these theories, emphasizing how different theoretical perspectives inform practices and policy.

RESULTS AND DISCUSSION

Spearman's General Intelligence

As a scholar deeply engaged with the intricate landscape of intelligence, one recognizes Charles Spearman's two-factor theory of intelligence as an indispensable starting point for any rigorous discussion. His introduction of the "general intelligence" factor, or *g*, marked a pivotal moment in the scientific conceptualization and measurement of human cognitive abilities. Spearman's theory, first formally articulated in 1904 and further developed in 1927, proposed that performance on all mental ability tests is underpinned by a single, overarching cognitive capacity: the *g* factor (Rowe et al., 2021; Spearman, 1904).

The **g** factor represents the common variance across diverse intellectual tasks, indicating that individuals who perform well in one cognitive domain tend to perform well in others (Cianciolo & Sternberg, 2004; Jensen, 1993). Spearman described g as a fundamental mental energy underlying all intellectual activity (Bickley et al., 1995; Hrbáčková et al., 2016). In addition to g, he proposed **specific** abilities (s factors) that are unique to particular tasks, such as mathematical or verbal skills. While s factors explain performance in specific domains, their effectiveness is ultimately influenced by the overarching g factor, making g the primary determinant of overall intellectual capacity.

Spearman's theory made several major contributions to intelligence research. It introduced **factor analysis**, enabling the scientific measurement of intelligence and the discovery of latent variables (Cianciolo & Sternberg, 2004; Spearman, 1904). The concept of g explained the **positive manifold**, where cognitive tests tend to correlate positively, and guided the development of modern intelligence assessments. Empirical studies show that g strongly predicts academic achievement, job performance, career attainment, and aspects of health, reinforcing its importance in educational psychology and personnel selection.

Despite its influence, the theory has faced substantial criticism. Critics argue that reducing intelligence to a single factor oversimplifies the complexity of human cognition and may reflect a statistical artifact rather than a real psychological construct (Kovács & Conway, 2019). Alternative theories, such as Multiple Intelligences and the Triarchic Theory, emphasize creative and practical abilities beyond academic intelligence. Additional concerns include the limited focus on cognitive processes, potential cultural bias in IQ testing, and the risk of narrowing definitions of giftedness in educational settings.

Thurnstone's Primary Mental Abilities

While Spearman emphasized a singular general intelligence factor, Louis Thurstone presented a contrasting perspective by proposing that intelligence comprises several distinct, uncorrelated primary mental abilities, challenging the notion of a unitary construct. Thurstone's theory of Primary Mental Abilities (PMA) fundamentally challenged the prevailing view of a singular general intelligence, or *g*, as proposed by Spearman. His work, particularly his 1938 publication "Primary Mental Abilities," argued for a more nuanced understanding of intellect, suggesting that intelligence is not a monolithic construct but rather comprises several distinct yet interrelated capabilities (Cianciolo & Sternberg, 2004). Through his innovative application of multiple-factor analysis, Thurstone aimed to identify these fundamental components of intelligence, offering a significant advancement in the methodology of psychometric research (Cianciolo & Sternberg, 2004; Sternberg & Grigorenko, 2001). He conceptualized these as separate "health conditions," each with unique "symptoms," contrasting sharply with Spearman's unitary view of a single intellectual health state (Cianciolo & Sternberg, 2004).

Thurstone identified seven Primary Mental Abilities (PMAs): verbal comprehension, verbal fluency, number, memory, perceptual speed, inductive reasoning, and spatial visualization (Cianciolo & Sternberg, 2004; Lang et al.,

2010; Massaldjieva, 2018). His theory proposed that individuals show different patterns of strengths and weaknesses across these abilities, offering a more differentiated profile than a single g factor. This separation of abilities provided a foundation for a more detailed understanding of intellectual functioning (Thurstone, 1936).

Thurstone's contributions were significant. His refinement of factor analysis and introduction of simple-structure rotation advanced psychometric methods and challenged the dominance of a single general factor (Sternberg & Grigorenko, 2001). His work encouraged multifactor models of intelligence, influencing later theories by Guilford, Gardner, and Sternberg. The PMAs also guided the development of intelligence tests that measure separate cognitive abilities and supported differentiated instruction, suggesting teaching can be tailored to individual strengths (De Jesus, 2012; Subban, 2006).

Despite its impact, the theory faced criticism. Research showed that PMAs are often intercorrelated, suggesting the presence of a higher-order g factor (Cianciolo & Sternberg, 2004). The exact number of abilities was also debated, as results varied depending on methods and tests. Like other early psychometric models, the theory focused more on the structure of intelligence than on cognitive processes. Later hierarchical models, such as the Cattell–Horn–Carroll framework, ultimately integrated PMAs within a broader system that includes both general and specific abilities.

Guilford's Structure of Intellect Model

Building on Thurstone's multi-factor approach, J. P. Guilford further expanded the conceptualization of intelligence by proposing a highly comprehensive, three-dimensional Structure of Intellect model that moved beyond a simple list of abilities to categorize intellectual factors along operations, contents, and products (Sternberg & Grigorenko, 2001). Guilford's Structure of Intellect model represents a highly ambitious and intricate attempt to delineate the facets of human cognitive ability, positioning itself as a radical departure from more parsimonious theories of intelligence prevalent in the mid-20th century (Cianciolo & Sternberg, 2004). Emerging at a time when debates still largely centered on Spearman's *g* factor and Thurstone's Primary Mental Abilities, Guilford introduced a framework of unprecedented complexity, fundamentally altering the discourse on the architecture of the human intellect (Cianciolo & Sternberg, 2004).

Guilford's Structure of Intellect (SI) theory rejected the idea of a single general intelligence (g) and proposed that intelligence consists of many distinct abilities (Cianciolo & Sternberg, 2004). He initially identified 120 abilities and later expanded the model to 180. The theory is organized as a three-dimensional cube consisting of Operations (cognitive processes such as cognition, memory, divergent and convergent production, and evaluation), Contents (types of information: figural, symbolic, semantic, behavioral), and Products (forms of outcomes such as units, relations, systems, and transformations). Guilford also integrated creativity as part of intelligence, particularly through divergent production, and developed tests to measure these specific abilities.

The SI model made several major contributions. It broadened the concept of intelligence beyond traditional academic abilities and influenced later holistic theories, including those of Gardner and Sternberg. Guilford played a key role in integrating creativity research into intelligence studies and inspired the development of creativity assessments. His work also emphasized the importance of empirically testing intelligence theories and encouraged the development of more differentiated cognitive assessments.

Despite its contributions, the model faced strong criticism. Its extreme complexity and large number of abilities made it difficult to test and apply. Empirical studies often found that many abilities were intercorrelated, suggesting higher-order factors or a general intelligence. Some proposed abilities were considered possible statistical artifacts, and tests of divergent production showed weak predictive validity. Additionally, the model focused on the structure of intelligence but offered limited explanation of the cognitive processes underlying real-world problem solving.

Verbal-Perceptual-Image Rotation Model

An alternative view of intelligence emerged with the Verbal-Perceptual-Image Rotation model, which organizes cognitive abilities into a hierarchical structure that includes a general intelligence factor alongside specific verbal, perceptual, and image rotation abilities (Johnson & Bouchard, 2005). The Verbal-Perceptual-Image Rotation model, developed notably by Johnson and Bouchard, represents a significant contribution to this ongoing psychometric discourse, offering a hierarchical framework that synthesizes general intelligence with more specific broad factors.

The VPR model proposes a hierarchical structure of intelligence that retains the general intelligence factor (g) while identifying three broad abilities: Verbal, Perceptual, and Image Rotation (Johnson et al., 2006). These abilities represent the main ways g is expressed, covering language skills, sensory organization, and mental manipulation of visual imagery. The model found strong correlations between verbal–perceptual and perceptual–rotation abilities, but weaker links between verbal and rotation abilities. Later refinements suggested a four-stratum model and aligned the framework with neurological perspectives on brain functioning.

The VPR model contributes significantly to intelligence research. It offers an improved statistical alternative to earlier psychometric models and provides a more nuanced understanding of intelligence by combining g with clearly defined broad abilities. The model also highlights the importance of visuospatial skills, particularly mental rotation, as a core component of intelligence. Additionally, studies using the VPR framework have explored genetic and environmental influences, enriching understanding of the development and heritability of cognitive abilities.

Despite its strengths, the VPR model has not replaced other dominant frameworks such as the Cattell–Horn–Carroll model. Like many psychometric approaches, it focuses on the structure of intelligence rather than the underlying cognitive processes. Factor-analytic models infer abilities from test correlations, leaving questions about the mechanisms of intelligence unresolved. Ongoing

research may refine or expand the model, reflecting the evolving and complex nature of human cognition.

Cattell and Horn's Gf-Gc Model

The work of Raymond Cattell and John Horn on fluid (Gf) and crystallized (Gc) intelligence stands as a monumental contribution to the conceptualization of human cognitive abilities, offering a hierarchical framework that elaborates upon earlier theories while striving for greater explanatory power regarding individual differences (Sternberg, 1999, 2015). Initiated by Cattell in 1943 and substantially refined with Horn in the 1960s, this model posits that overall cognitive ability is differentiated into two broad, yet distinct, classes of intelligence, which represent different developmental trajectories and cognitive functions (Bovaird, 2009; Cattell, 1963; Horn & Cattell, 1966). The Gf-Gc model has profoundly influenced psychometric practice and theory, laying foundational groundwork for the widely accepted Cattell-Horn-Carroll theory (McGrew, 2008; Schneider & McGrew, 2018).

The Gf–Gc model distinguishes two fundamental forms of intelligence: Fluid Intelligence (Gf) and Crystallized Intelligence (Gc). Gf refers to the capacity to reason, solve novel problems, adapt to new situations, and process information independently of prior learning. It includes inductive and deductive reasoning, abstract thinking, and identifying patterns or relationships. Accordingly, Gf is commonly measured using non-verbal and culturally reduced tasks such as matrices, series completion, and abstract reasoning tests. In contrast, Gc represents accumulated knowledge, vocabulary, and skills gained through education and cultural experience, typically measured through comprehension, vocabulary, and general knowledge assessments. A key assumption of the model concerns their developmental relationship: Gf tends to peak in early adulthood and gradually decline with age, while Gc generally grows or remains stable across the lifespan. Horn and Cattell proposed that Gf supports the development of Gc, as individuals with stronger reasoning abilities can acquire knowledge more efficiently.

The Gf–Gc model has had a major influence on intelligence research, assessment, and educational practice. By distinguishing reasoning ability from acquired knowledge, it provided a more nuanced explanation of cognitive development and helped reconcile findings on both stability and change in intelligence across the lifespan. The model later merged with Carroll's Three-Stratum Theory to form the Cattell–Horn–Carroll (CHC) theory, now considered the most comprehensive psychometric framework of intelligence. This integration has guided the development of modern intelligence tests, including the Woodcock–Johnson and Kaufman Assessment Battery for Children, which provide separate Gf and Gc scores. Such assessments are widely used to identify intellectual strengths, diagnose learning difficulties, and support educational and clinical decision-making. The distinction also contributed to understanding the Flynn Effect, as generational IQ gains appear stronger in Gf measures, suggesting environmental influences on cognitive development.

Despite its influence, the Gf–Gc model continues to be refined. Debate persists regarding the role of Spearman's general intelligence (g), as empirical

findings often show strong correlations between Gf and Gc, supporting hierarchical models that place g at the top. Separating Gf and Gc in practice is also challenging because culture-fair tests still involve learning, while Gc tasks require reasoning to apply knowledge. Over time, the model expanded to include additional broad abilities, increasing complexity and raising questions about parsimony. Furthermore, the model mainly describes the structure of intelligence rather than the underlying cognitive processes, prompting newer research exploring neurological and executive-function foundations. Recent discussions also question the direct application of human psychometric frameworks to artificial intelligence, suggesting that human-centered models may not fully capture the nature of machine cognition.

Carroll's Three- Stratum Hierarchy

John B. Carroll's Three-Stratum Theory of cognitive abilities, published in 1993, stands as a monumental achievement in psychometric intelligence research. It represents a comprehensive synthesis of nearly a century of factor-analytic studies, offering a hierarchical framework that elegantly reconciles previously disparate views on the structure of intelligence. This work continues to profoundly influence intelligence theories, test development, and interpretation (McGrew, 2023).

Carroll's Three-Stratum Theory of Intelligence is a hierarchical model derived from the reanalysis of extensive intelligence-test data. At the top (Stratum III) lies general intelligence (g), the broad factor underlying all cognitive abilities. Below it, Stratum II consists of eight to ten broad abilities such as fluid intelligence (Gf), crystallized intelligence (Gc), general memory and learning, visual and auditory perception, retrieval ability, cognitive speediness, and processing speed. At the lowest level (Stratum I) are around 70 narrow abilities that represent specific skills within each broad domain, such as mathematical reasoning or vocabulary knowledge. By integrating elements from Spearman's g and the Gf–Gc theory, Carroll created a coherent and empirically supported framework that captured the hierarchical organization of human intelligence.

The Three-Stratum Theory is highly influential because it synthesized decades of psychometric research into a unified model. It reconciled competing perspectives from earlier theories and became a central component of the Cattell–Horn–Carroll (CHC) theory, now the most widely accepted framework for understanding intelligence. The hierarchical structure also improved intelligence assessment by allowing measurement at multiple levels, from overall g to detailed profiles of broad and narrow abilities. This approach supports more precise diagnosis, targeted educational interventions, and informed clinical decision-making. Carroll's work continues to shape modern research and provides a common theoretical language for studying cognitive abilities.

Despite its strong empirical support, the theory continues to generate debate. Researchers differ on how best to conceptualize g within the hierarchy, particularly whether higher-order or bifactor models better represent the relationships among abilities. The large number of narrow abilities can also complicate interpretation for practical use. Like other psychometric models, the theory primarily explains the structure of intelligence rather than the cognitive

processes underlying it, encouraging ongoing research into neurological and process-based explanations. Additionally, differences sometimes exist between theoretical CHC alignment and real-world assessment practices, highlighting the challenge of translating complex theory into universally applicable testing tools.

Cattell-Horn-Caroll Theory

The Cattell-Horn-Carroll theory stands as the most comprehensive and empirically supported psychometric theory of the structure of cognitive abilities to date (Schneider & McGrew, 2018). This theory represents a monumental synthesis, integrating the pioneering work of Raymond Cattell and John Horn's fluid-crystallized (Gf-Gc) theory with John B. Carroll's Three-Stratum Theory (McGrew, 2008; Schneider & McGrew, 2012, 2018). Its development resolved historical debates and offered a unified understanding of intelligence that continues to profoundly influence intelligence theories, test development, and interpretation.

The Cattell–Horn–Carroll (CHC) theory of intelligence is a hierarchical framework that integrates Carroll's Three-Stratum Theory with the Gf–Gc distinction. At the top (Stratum III) lies general intelligence (g), the broad factor underlying all cognitive abilities. Beneath it (Stratum II) are around 16–17 broad abilities representing major domains of cognition. These include Fluid Reasoning (Gf), the ability to solve novel problems and adapt to new situations, and Crystallized Intelligence (Gc), the accumulation of knowledge and skills gained through education and experience. Other broad abilities include long-term storage and retrieval, visuospatial processing, auditory processing, short-term memory, processing speed, quantitative reasoning, and decision or reaction time. At the lowest level (Stratum I) are approximately 70–80 narrow abilities—highly specific cognitive skills such as vocabulary knowledge or mathematical reasoning that load onto the broader domains. Together, these levels present intelligence as both multidimensional and integrated, offering a comprehensive taxonomy of human cognitive abilities.

The CHC theory has become the most influential model in modern intelligence research and assessment. By synthesizing earlier traditions—Spearman's g, Thurstone's multiple factors, and Cattell and Horn's Gf–Gc theory—it provides a unified framework and common language for studying cognitive abilities. Importantly, it serves as the blueprint for most contemporary intelligence tests, enabling detailed profiles of individuals' cognitive strengths and weaknesses beyond a single IQ score. This richer understanding supports more accurate diagnoses, targeted educational interventions, and improved clinical decision-making. Its hierarchical structure and many of its proposed abilities have been consistently supported by factor-analytic studies across diverse populations and cultures, reinforcing its strong empirical foundation.

Despite its prominence, the CHC theory continues to face debate and refinement. Researchers disagree about the precise role of g, particularly whether higher-order or bifactor models best represent its influence across abilities. The model's comprehensiveness also introduces complexity, making interpretation challenging for non-specialists. Like many psychometric frameworks, CHC primarily describes the structure of intelligence rather than the cognitive

processes underlying intelligent behavior. Additionally, discrepancies sometimes arise between the theoretical CHC framework and how intelligence tests align with it in practice. Recent discussions even question how well human-centered psychometric models translate to artificial intelligence, highlighting the need for continued research and theoretical development.

Planning, Attention, Simultaneous, Successive (PASS) Theory of Intelligence

Another prominent theoretical framework, the Planning, Attention, Simultaneous, Successive theory, offers an alternative perspective on cognitive abilities, emphasizing distinct information processing functions rather than a hierarchical structure of abilities (Sternberg, 2015). The Planning, Attention, Simultaneous, Successive theory of intelligence, developed by J. P. Das, Jack Naglieri, and John Kirby, represents a significant departure from purely psychometric, factor-analytic models. Rooted in A. R. Luria's neuropsychological work, the PASS theory proposes a process-oriented understanding of intelligence, suggesting that cognitive processing—rather than just abilities—is the foundation of intellectual functioning (Das & Abbott, 1995; Kirby & Das, 2022; Naglieri & Das, 1990). This model has profoundly influenced how we conceptualize assessment and intervention in educational and clinical settings (Bonsteel, 2012).

The core of the PASS theory identifies four fundamental cognitive processes that form a complex and interdependent system, essential for understanding mental functioning and individual differences (Bonsteel, 2012; Das & Abbott, 1995; Kirby & Das, 2022). Planning refers to the cognitive processes individuals use to determine how to solve problems, make decisions, regulate and monitor their actions, and develop strategies for goal attainment (Corbo & Casagrande, 2022; Sternberg, 1980). It involves selecting, implementing, and evaluating plans of action, enabling organized behavior and thinking about the future to achieve a goal through a series of intermediate steps (Corbo & Casagrande, 2022). Attention involves the focused and selective concentration on relevant stimuli while ignoring distractions. It is crucial for maintaining an appropriate level of arousal and vigilance, ensuring that an individual can sustain cognitive activity over time and resist irrelevant information (Oberauer, 2024). Simultaneous Processing refers to the integration of individual pieces of information into a unified, holistic group or gestalt (Kirby & Das, 2022). It involves perceiving and understanding how various elements are interrelated to form a complete picture, often used in tasks requiring comprehension of complex relationships, such as grasping the meaning of sentences or interpreting patterns (Kirby & Das, 2022). In contrast, Successive Processing involves organizing information in a specific serial order, where each item is processed sequentially, one after another, in a chain-like fashion (Kirby & Das, 2022). This is critical for tasks requiring sequencing, such as remembering a series of digits, following instructions, or understanding the syntax of a sentence (Das, 2002). These four processes are not seen as static abilities but as dynamic neurocognitive processes based on brain function, which collectively contribute to intelligent behavior (Naglieri & Das, 1990; Naglieri & Otero, 2024). The PASS model is suggested as

an alternative approach to measuring and studying intelligence, challenging traditional methods (Das & Abbott, 1995; Naglieri & Das, 1990).

The PASS theory offers several crucial contributions to the field of intelligence, particularly in its emphasis on process-based understanding and its implications for applied settings. Firstly, it emphasizes cognitive processes over static abilities, providing a framework for understanding individual differences in intelligence (Bonsteel, 2012). It challenges traditional methods of studying and measuring intelligence by focusing on the operational units of attention, simultaneous and successive processing, and planning (Das & Abbott, 1995), and has been described as an alternative to the conceptualization of intelligence as a general mental ability (Fein & Day, 2003). Secondly, grounded in Luria's neuropsychological model of brain function, PASS theory offers a framework that bridges cognitive psychology with neurobiology. This foundation lends ecological validity to the constructs and suggests potential biological underpinnings for individual differences in these processes (Naglieri et al., 2008; Naglieri & Das, 1990). Thirdly, the theory has led to the development of specific assessment instruments, most notably the Cognitive Assessment System, which measures these four processes (Bonsteel, 2012; Fein & Day, 2003; Naglieri & Otero, 2024). This allows for an examination of a pattern of strengths and weaknesses related to academic variability and diagnosis, offering a theory-based approach to intervention and remediation, particularly for individuals with learning disabilities (Bonsteel, 2012; Das, 2002; Kirby & Das, 2022; Naglieri & Otero, 2024). Research consistently indicates a moderate-to-strong relationship between PASS processes and academic achievement in reading and mathematics (Georgiou et al., 2020). Lastly, proponents argue that the PASS theory and its corresponding assessments offer a more equitable approach to intelligence testing. By focusing on cognitive processes rather than culturally loaded knowledge, it aims to reduce test bias and provide a fairer evaluation of intellectual potential across diverse populations (deLeyer-Tiarks et al., 2024; Naglieri & Otero, 2024). The theory provides a robust framework for conceptualizing assessment and directly leads to theory-based remediation (Bonsteel, 2012).

Despite its strengths and applied utility, the PASS theory has also faced critical examination. Studies have raised questions about the precise factor structure of the PASS model. For instance, some research suggests that the original PASS model may provide an improper factor solution for certain data, and that individual differences in the Planning and Attention factors may be indistinguishable (Kranzler & Weng, 1995). This indicates that further refinement of the PASS theory or its associated tests, or perhaps both, might be necessary (Kranzler & Weng, 1995). Furthermore, while the PASS theory aims to offer an alternative to traditional *g*-centric models, the presence of a substantial *g* factor among the PASS tests has been observed in some analyses (Kranzler & Weng, 1995). This raises questions about the extent to which the PASS processes truly operate independently of a general intellectual ability, or whether *g* is still a higher-order factor that influences these processes. Another critique pertains to the predictive validity of planning scores; in some studies, planning scores have

not been significantly related to all learning criteria. For example, one study found that planning scores were not significantly related to any of the learning criteria for the acquisition of a complex skill, while successive processing, simultaneous processing, and attention scores showed significant contributions (Fein & Day, 2003). This suggests that the predictive utility of all four PASS processes may vary depending on the specific criteria being evaluated. Finally, the field of intelligence research continues to debate the merits of descriptive structural models (like CHC) versus process-oriented models (like PASS). While the CHC model is widely accepted for its detailed hierarchical taxonomy, it primarily describes the *organization* of individual differences in intelligence rather than explaining them through cognitive processes (Frischkorn & Schubert, 2018). This highlights the ongoing challenge for both types of models to fully account for the complexities of intelligent behavior.

Gardner's Theory of Multiple Intelligences

In contrast to the more process-oriented models, Gardner's Theory of Multiple Intelligences proposes that intelligence is not a singular, monolithic entity but rather a collection of distinct, independent intelligences (Sternberg & Grigorenko, 2002). Howard Gardner's Theory of Multiple Intelligences, first introduced in his seminal 1983 work *Frames of Mind*, profoundly challenged traditional, unitary conceptions of intelligence, particularly those measured by IQ tests (Gardner, 1987, 1996, 2017; Snow, 1985). Gardner posits that intelligence is not a singular, monolithic trait but rather a multifaceted construct, encompassing several distinct, relatively autonomous intelligences that individuals draw upon to solve problems and create products valued within their cultural contexts (Gardner, 1987; Gardner & Hatch, 1989; Lumei & Turda, 2022; Sternberg, 2014) This theory has exerted substantial influence on educational practices and policies, particularly in early childhood and secondary education (Sharma, 2023).

Gardner initially proposed seven intelligences, later expanding the list to eight, and considering a ninth(Gardner, 1987; Sharma, 2023)These include Linguistic Intelligence, defined as the capacity to think in words and use language to express and appreciate complex meanings. Logical-Mathematical Intelligence involves the ability to carry out mathematical operations and critically analyze problems, encompassing logical reasoning and scientific investigation. Spatial Intelligence refers to the capacity to think in three dimensions and to perceive the external and internal visual world accurately, allowing one to manipulate objects mentally. Musical Intelligence is the ability to produce and appreciate rhythm, pitch, and timbre, demonstrating an appreciation of the forms of musical expressiveness. Bodily-Kinesthetic Intelligence is the capacity to manipulate objects and use one's body skillfully for expressive or goal-directed purposes. Interpersonal Intelligence describes the ability to understand and interact effectively with others, recognizing their moods, intentions, motivations, and feelings. Intrapersonal Intelligence is the capacity to understand oneself—one's emotions, motivations, and desires—and to use this knowledge to guide one's behavior. Finally, Naturalistic Intelligence is the ability to recognize and categorize flora and fauna in one's environment,

as well as other natural feature(Gardner, 1987) central tenet of MI theory is that each person possesses all intelligences, though they function together in ways unique to each individual. Most people can develop each intelligence to an adequate level of competency, and intelligences usually work together in complex ways (Achkovska-Leshkovska & Spaseva, 2016). Gardner argues that only linguistic and logical-mathematical intelligences have traditionally been valued and tested in modern schools, referring to this combination as "academic" or "scholarly intelligence"(Gardner, 1987) suggests that each of these intelligences is underpinned by unique neural pathways, developmental processes, and evolutionary histories (Kadis et al., 2024).

The significance of Gardner's MI theory is multi-faceted. Firstly, it significantly broadened the understanding of intelligence beyond the narrow confines of traditional psychometric definitions, which often centered on verbal and logical-mathematical abilities. This broadened perspective highlighted that individuals can be competent in various domains, reshaping pedagogical practices and prompting a re-evaluation of educational curricula (Kadis et al., 2024). This viewpoint encourages educators to see each student as a unique individual with diverse potentials (Prodyanatasari et al., 2023). Secondly, the theory has had a profound impact on educational practice, with many schools structuring curricula based on its principles (Achkovska-Leshkovska & Spaseva, 2016; Gardner, 1987)ages educators to adopt a more personalized and differentiated approach to teaching, tailoring instructional methods and activities to suit the diverse intelligences present in their classrooms (Prodyanatasari et al., 2023). Gardner himself offered suggestions for educational use, emphasizing individualization and pluralization through multiple "entry points" or varied modes of delivery to engage all intelligences and enhance learning effectiveness (Achkovska-Leshkovska & Spaseva, 2016; Harb et al., 2025) valuing the diversity of intelligences, the theory promotes human potential, helping to motivate students, build self-confidence, and enhance academic and personal achievements (Prodyanatasari et al., 2023). The theory suggests that individual potential can be developed through effort, practice, and experience, aligning with growth mindset principles .

Despite its popularity, particularly in educational circles, Gardner's Theory of Multiple Intelligences has faced substantial and persistent criticism from within the psychological and psychometric communities. One of the most significant critiques centers on the perceived lack of robust empirical evidence to support the theory's core tenets (Ferrero et al., 2021; Waterhouse, 2006, 2023) that Gardner has not provided sufficient psychometric data, such as factor analytic studies, to demonstrate the independence of these intelligences or to confirm their existence as distinct construct (Klein, 1997; Waterhouse, 2023) Researchers assert that there is no evidence supporting his proposal for independent brain-based intelligences(Waterhouse, 2023) or criticism is directed at Gardner's definition of "intelligence," which critics argue is too broad, blurring the line between intelligence and talent or aptitude. What Gardner labels as separate intelligences might be more accurately described as cognitive styles, domains of talent, or personality traits rather than fundamental types of intelligence (Klein,

1997). Furthermore, the theory has been criticized for the absence of standardized, reliable, and valid measures for each of the proposed intelligences. Without such measures, it becomes difficult to empirically test the theory, assess individual profiles of intelligence, or evaluate the effectiveness of MI-based interventions (Ferrero et al., 2021). Studies on the efficacy of MI-inspired methodologies have shown methodological flaws, making a valid evaluation difficult (Ferrero et al., 2021). While Gardner claims the intelligences are relatively autonomous, empirical studies, particularly factor analyses, have often shown intercorrelations among them, suggesting the presence of a general intelligence factor (*g*) that underlies them (Waterhouse, 2023). This challenges the notion that these intelligences operate as truly independent entities. Finally, some researchers have labeled MI theory as a "neuromyth," arguing that there is no neurological evidence to support Gardner's claim of independent brain-based intelligences for different types of cognitive abilities (Waterhouse, 2023) clarified that he never claimed his theory was solely a neurological one, the lack of supporting neuroscience findings is a persistent critique (Waterhouse, 2023).

Sternberg's Triarchic Theory of Intelligence

Robert Sternberg's Triarchic Theory of Intelligence presents an alternative, multifaceted framework that seeks to address some of the limitations of both traditional unitary models and Gardner's pluralistic approach (Çalık, 2013). Robert J. Sternberg's Triarchic Theory of Intelligence, first proposed in the early 1980s and later refined into the Theory of Successful Intelligence, represents a significant attempt to move beyond traditional, psychometric views of intelligence (Sternberg, 1984). Sternberg argued that past research on intelligence had often overemphasized easily measurable aspects, leading to a narrow understanding of what constitutes intelligent behavior ("Triarchic Theory of Intelligence," 2008). His theory endeavors to provide a broader basis for understanding intelligence by explaining how different aspects of intelligence interrelate and function as a system (Sternberg, 1987, 2018). The history of defining intelligence is deeply rooted in various philosophical and psychological perspectives, predominantly focusing on the ability to implement goal-directed adaptive behaviors (Hunt, 2001).

Sternberg's Triarchic Theory is called "triarchic" because it originally comprised three interconnected subtheories, or aspects of intelligence: componential (analytical), experiential (creative), and contextual (practical) (Sternberg, 1984, 1999). These three aspects are distinct yet are believed to work together to enable individuals to achieve success in life according to their own definition (Sternberg, 1999). Analytical Intelligence relates to the internal world of the individual, specifying the mental mechanisms that lead to intelligent behavior (Sternberg, 1986, 2018). It involves the mental processes, or components, used to plan, monitor, and evaluate problem-solving activities (Sternberg, 1989). Sternberg identified three types of components: metacomponents (executive processes for planning and evaluation), performance components (executing plans), and knowledge-acquisition components (learning new information) (Sternberg, 1980, 1999). Analytical intelligence is typically involved when these components are applied to analyze, evaluate, judge, or compare and contrast

relatively familiar, abstract problems (Sternberg, 1999). Creative Intelligence emphasizes the role of experience in intelligence, focusing on how individuals deal with novelty and automatize mental processing (Sternberg, 1986, 2018). Creative intelligence involves the ability to generate new ideas, solve novel problems, and handle new situations effectively (Sharma & Singh, 2025). It is most evident when individuals are confronted with tasks that are relatively new to them, or when they need to automatize responses to familiar tasks (Sternberg, 2018). Practical Intelligence relates intelligence to the external world of the individual, focusing on the use of mental mechanisms in everyday life to attain an intelligent fit to the environment (Sternberg, 2018). It involves adapting to, shaping, and selecting real-world environments (Sternberg, 1984). Much of Sternberg's work on practical intelligence centers on the concept of tacit knowledge, defined as what one needs to know to work effectively in an environment, which is often not openly expressed or formally taught (Sternberg, 1999; Wagner & Sternberg, 1985). This tacit knowledge, gained through experience and action, can be quantified and taught (Sternberg et al., 2000). Practical intelligence is crucial for success in daily life and often involves applying abilities to real-world problems on the job or at home (Sternberg, 1999). Sternberg later augmented the theory to include Wisdom, defining it as the application of intelligence, creativity, and knowledge for the common good, balancing intrapersonal, interpersonal, and extra-personal interests through ethical values (Sternberg, 2009). The theory proposes that these abilities are modifiable, rather than fixed, and views abilities and achievement as being on a continuum (Sternberg, 2009).

The Triarchic Theory of Intelligence holds significant importance for several reasons. Firstly, Sternberg's theory significantly broadened the understanding of intelligence beyond the narrow confines of traditional psychometric definitions centered on verbal and logical-mathematical abilities (Sternberg, 2009; "Triarchic Theory of Intelligence," 2008). It highlighted that individuals can be competent in various domains, emphasizing practical and creative aspects alongside analytical ones crucial for real-world success (Sternberg, 1999). This challenged the notion that conventional tests, which heavily emphasize analytical abilities, are fully adequate (Sternberg, 2009). Secondly, the theory brought attention to the crucial role of practical intelligence and tacit knowledge, which were often overlooked by conventional tests but are vital for navigating complex everyday situations and job performance (Sternberg, 1999; Sternberg et al., 2000). Measures of tacit knowledge have been shown to predict job performance as well as or better than conventional intelligence tests (Sternberg, 2002). Thirdly, the Triarchic Theory has strong implications for education, suggesting that instruction should foster all three aspects of intelligence—analytical, creative, and practical—rather than solely focusing on analytical skills (Sternberg, 1984). This encourages teaching methods that promote critical thinking, creativity, and real-world problem-solving (Hunt, 2008). Sternberg proposed that a theory encompassing all three elements provides better prediction of success in life than a theory comprising just the analytical element (Sternberg, 1999). Finally, by emphasizing components of

intelligence, the theory delves into the cognitive processes underlying intelligent behavior, moving beyond a mere description of abilities to explore *how* intelligence operates (Sternberg, 1986, 1999). This systemic approach interrelates different aspects of intelligence to understand its functional mechanisms (Sternberg, 2018).

Despite its appealing comprehensiveness and educational influence, Sternberg's Triarchic Theory has faced several significant critiques. One of the most significant criticisms is the empirical finding of high intercorrelations among the three proposed intelligences in independent factor-analytic studies (Chooi et al., 2014). Critics argue that these findings often suggest the presence of a strong general intelligence factor (*g*) that accounts for much of the variance, rather than three truly independent factors (Chooi et al., 2014). Sternberg's own Triarchic Abilities Test was developed to investigate the internal validity of the theory (Sternberg & Grigorenko, 2002), but external analyses have questioned whether the triarchic model is empirically supported or if a unitary construct (like *g*) is a better explanation for individual differences (Chooi et al., 2014). This points to ongoing measurement challenges, particularly in creating reliable and valid instruments that can clearly differentiate creative and practical intelligences from analytical abilities and from a general intelligence factor (Sternberg, 1999, 2018). Secondly, critics contend that the distinctions between the three intelligences can be blurry, leading to considerable conceptual overlap. For instance, creative tasks often require analytical skills for evaluation, and practical problem-solving frequently draws upon both analytical and creative thinking (Sharma & Singh, 2025). The empirical intercorrelations found by researchers further highlight this issue, suggesting that the aspects may not be as psychologically distinct as theorized (Chooi et al., 2014). Thirdly, while aiming for a more complete picture of intelligence, some critics find the theory less parsimonious than other models. They argue that if conventional psychometric criteria are applied, simpler explanations might be found for the observed phenomena, suggesting that the model, in its complexity, may not always be justified for practical applications (Hunt, 2008). Finally, despite Sternberg's efforts to broaden the concept of intelligence beyond *g*, the consistent observation of intercorrelations among the three abilities raises questions about their independence from a general intellectual factor. While Sternberg's work argues for abilities beyond general intelligence, the degree to which these are truly separate from *g* remains a point of contention within the psychometric community (Sternberg, 2009).

Educational Implications for the Identification of Gifted Learners

The identification of gifted learners has historically been dominated by traditional psychometric measures, particularly IQ tests. However, a critical perspective reveals significant limitations and challenges with this approach. While high IQ scores have long been associated with giftedness, contemporary theories increasingly view giftedness as a multifaceted phenomenon influenced by both cognitive and non-cognitive factors, moving beyond a sole reliance on a single, one-hour segment of a young person’s total being (Kuznetsova et al., 2024; Renzulli, 2003). This narrow definition often oversimplifies human intelligence,

failing to capture its diverse nature and potentially overlooking various forms of talent (Çalık, 2013).

A major critique of traditional identification methods is their role in the persistent underrepresentation of low-income and minority students in gifted programs (Card & Giuliano, 2015, 2016; Hodges et al., 2018). The conventional process, often relying on parent and teacher referrals, tends to systematically miss potentially qualified disadvantaged students (Card & Giuliano, 2015, 2016). Research indicates that while non-traditional identification methods have helped to narrow this proportional identification gap, they have not fully resolved the issue of educational inequity (Hodges et al., 2018). This highlights the need for more equitable and comprehensive identification procedures. Some scholars, like Sternberg, critically assert that measures used in gifted identification, while predicting future success, may not be complete or adequate for comprehensive identification, suggesting that the field often legitimizes itself on potentially misleading correlations (Sternberg, 2022).

To address these limitations, educational implications for identification emphasize the necessity of employing multiple indicators (Worrell & Erwin, 2011). This includes using predictors of high functioning that are both general, such as IQ, and domain-specific, such as achievement test scores and other academic indicators (Worrell & Erwin, 2011). Furthermore, any identification procedure should consider the background factors that enable the demonstration of talent and potential. There is a call to re-examine identification procedures that result in the pre-selection of certain students, advocating instead for an orientation toward developing "gifted behaviors" in specific students, at specific times, and under specific circumstances (Renzulli, 2003). This more flexible approach is seen as fairer and more consistent with research on gifted individuals (Renzulli, 2003). Crucially, teachers require careful training in identifying gifted students, particularly those from diverse backgrounds, to ensure equitable representation (Lee et al., 2022).

Educational Implications for the Education of Gifted Learners

Once identified, the education of gifted learners demands specialized approaches that go beyond typical classroom instruction. The fundamental implication is the need for differentiation in curriculum and pedagogy (Munro, 2013). Gifted learners typically possess enhanced metacognitive capacity, greater working memory capacity, and the ability to process and manipulate a higher information load, which enables them to engage in higher-level cognitive tasks and integrate understanding from multiple codes (Munro, 2013).

Effective educational strategies for gifted learners should prioritize advanced, research-based curricula that extend the standards set by organizations like the National Association for Gifted Children, as well as general education curricula (Kitsantas et al., 2017). Problem-based and inquiry-based learning curricula and instructional methods have proven effective in engaging gifted students (Kitsantas et al., 2017). The curriculum for the gifted is fundamentally guided by theories of differentiated learning, emphasizing advanced content, challenging tasks, and interdisciplinary learning

opportunities that differ from those afforded to non-identified learners (Shaunessy-Dedrick, 2018).

Specialized pedagogy for gifted learners often includes interest-based learning, curriculum compacting, project-based learning, and open-ended choice, allowing for the application of creative productivity (Reis et al., 2021). These strategies provide complex, advanced, and meaningful content delivered by knowledgeable teachers, at an appropriate pace, with adequate scaffolding and feedback (Siegle et al., 2016). Enrichment and acceleration are recognized as best practices, with enrichment involving academic modifications in speed, depth, and breadth within the same grade level, and acceleration referring to vertical programs like grade skipping or early entrance to higher education (Wu, 2013). Furthermore, educators must provide a continuum of services that will engage and challenge all gifted and talented students, addressing potential social and emotional challenges such as underachievement that can arise when students do not encounter sufficient challenge in school (Reis & Renzulli, 2011).

The various theories of intelligence discussed previously offer different lenses through which to conceptualize gifted education. Gardner's Theory of Multiple Intelligences, for example, heavily influences the development and delivery of gifted education by advocating for a recognition and nurturing of diverse intellectual strengths beyond traditional academic measures (Fell, 2001). Similarly, Sternberg's Triarchic Theory of Intelligence, with its emphasis on analytical, creative, and practical intelligences, implies that gifted programs should foster all three aspects, moving beyond a singular focus on analytical skills to promote critical thinking, creativity, and real-world problem-solving (Sternberg, 1984). This aligns with the call for differentiated instruction and a broader view of giftedness.

In conclusion, the educational implications for gifted learners are profound and demand a sophisticated understanding of intelligence, moving beyond simplistic definitions. Identification must evolve to be more equitable and comprehensive, utilizing multiple indicators and flexible approaches that recognize diverse talents. Education must be tailored through differentiated curricula and specialized pedagogies that offer advanced content, promote higher-order thinking, and foster creative and practical applications of knowledge. This critical discussion underscores the ongoing need for research-based practices and continuous refinement in both identifying and nurturing the full potential of gifted individuals.

CONCLUSIONS AND RECOMMENDATIONS

The journey through the conceptualization of intelligence reveals a rich and evolving landscape, transitioning from ancient philosophical musings on the nature of intellect to modern, empirically driven psychometric and process-oriented models. From Spearman's foundational "general intelligence" factor (*g*) to the differentiated constructs of Cattell and Horn's Gf-Gc model, Thurstone's Primary Mental Abilities, Guilford's expansive Structure of Intellect, and the integrative framework of the Cattell-Horn-Carroll theory, each model has contributed significantly to our understanding of human cognitive abilities.

Complementary process-based theories like PASS and multifaceted perspectives such as Gardner's Multiple Intelligences and Sternberg's Triarchic Theory have further broadened this understanding, emphasizing the diverse ways intelligence manifests and operates.

This comprehensive overview underscores that intelligence is not a singular, monolithic entity but a complex interplay of various cognitive capacities. For gifted identification and education, particularly in contexts like the Philippines, this nuanced understanding is critical. A sole reliance on traditional psychometric measures, such as IQ tests, has proven insufficient and often inequitable, leading to the underrepresentation of diverse talents. Instead, identification must evolve to be more comprehensive, incorporating multiple indicators and considering cultural and contextual factors to recognize the full spectrum of intellectual potential. Similarly, the education of gifted learners demands specialized and differentiated pedagogical approaches that foster analytical, creative, and practical skills, moving beyond conventional academic instruction.

Ultimately, the ongoing discourse surrounding intelligence theories, their strengths, and their critiques provides invaluable insights for creating more equitable, effective, and inclusive systems for identifying and nurturing gifted individuals, ensuring that diverse forms of talent are recognized and developed to their fullest potential.

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