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REVIEW ARTICLE

A Prelude to Understanding Cognitive Disabilities in Cattell-Horn-Carroll Framework

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ABSTRACT

This article is a prelude to the application of the Cattell-Horn-Carroll (CHC) theory in the assessment and intervention for school-age children with cognitive disabilities (CogDs). This is the most common disability type identified by special education officers, school counselors and/or psychologists among school-age children. CogDs (also known as intellectual disabilities or IDs for short) is a nebulous term that describes an individual who exhibits more than average difficulty with intellectual tasks. In defining CogDs, there are several overlaps between developmental and CogDs. These are broad terms used in literature but these labels do not indicate the level of ability or skills. Within the framework of cognition, there are four cognitive subcategories involving what are termed as (i) lexikos (ability to use and understand language and literacy skills), (ii) calculatos (ability to use and understand mathematics and numeracy skills), (iii) praxis (ability to perform voluntary skilled movements), and (iv) gnosis (ability to acquire knowledge and its meaning of self and the context in which self-engages). In each subcategory, there are two types of challenging cognitive issues: one is concerned with developmental delay (i.e., dyslexia, dyscalculia, dyspraxia and dysgnosia), and the other is concerned with neurological lesion or injury (i.e., alexia, acalculia, apraxia and agnosia). In this article, the authors re-examined the framework of CogDs, and also its related four subcategories to the Cattell-Horn-Carroll (CHC) theory of broad cognitive abilities.

***Keywords**: CHC theory, cognitive disability, intellectual disability, dyslexia, developmental disabilities*

1. INTRODUCTION

The term 'cognition' is one of the three human behavioral potentials, the other two being affect and conation [1], and as cognitive behavior, "as in the words 'recognize' and 'recognition', has to do with intellect, i.e., the use of the mind, whether it is logical or illogical" [1]. In other words, it refers to the mental or intellectual action or process involved in knowledge acquisition and comprehension through thought, experience, and the senses. This at-birth potential involves the implicit process of thinking (of course, not directly observable), "although an individual human may experience within himself what is called thinking". Moreover, cognition encompasses all aspects of intellectual functions and processes which include perception, attention, computation, concept/ knowledge formation, decision-making, evaluation (involving analysis and synthesis) and judgment, imagination (also known as fantasizing or sub-creating of all possibilities), intelligence, memory (including working memory), problem-solving, reasoning, reception and expression of language, and thought. All these cognitive processes use existing knowledge and also to discover new knowledge.

Closely related to cognition is the term 'cognitive ability'. According to McGue and Bouchard [2], cognitive ability constitutes one of the most extensively studied topics within the field of behavioral sciences including genetics and psychology. Cognitive ability is essential for human adaptation and survival, and it is sometimes referred to as general intelligence (g) [3]. It includes the capacity in learning quickly and from experience, planning, problem-solving, reasoning, thinking abstractly, and understanding complex ideas/concepts [4].

There are three terms that warrant disambiguation before proceeding: 'cognitive impairment', 'cognitive disability', and 'cognitive handicap'. Drawing on the World Health Organisation (WHO) [5] International Classification of Impairments, Disabilities, and Handicaps (ICIDH), 'impairment' refers to any loss or abnormality in psychological, physiological, or anatomical structure or function; 'disability' refers to any resulting limitation in performing activities within the range considered normal for a typically developed individual; and 'handicap' refers to the social disadvantage arising from impairment or disability.

Applied to cognition, 'cognitive impairment' denotes a more permanent loss of function, such as significant memory loss in severe dementia. 'Cognitive handicap' refers to an acquired inability to accomplish cognitively demanding tasks that others are typically able to perform. 'Cognitive disability' by contrast refers to specific, measurable limitations in mental functions and abilities that affect learning, social participation, and adaptive functioning. It is with this third term, and its subtype framework that this article is principally concerned.

Cognitive disability (CogDs) also referred to as intellectual disability (ID), describes an individual who has some specific limitations. These disabilities of cognition can slow down the learning process as well as the developing process of a child than a normal child. CogDs can be caused by a brain abnormality, genetic disorder, illness (e.g., meningitis), or an external insult (e.g., automobile accident). These disabilities of cognition can be assessed through administration of standardized intelligence and adaptive behavior tests.

The American Psychiatric Association (APA) [6] and the American Association on Intellectual and Developmental Disabilities (AAIDD) [7], have each developed their own diagnostic criteria for intellectual disabilities (IDs). Each of their diagnostic criteria protocol has its own merits. The APA's diagnostic criteria for ID (used to be known as mental retardation), found in the Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5) [6] are as follows:

(1) Deficits in intellectual functioning: It includes various mental abilities, i.e., abstract thinking, academic learning (i.e., the ability to learn in class/school via traditional pedagogy), experiential learning (i.e., the ability to learn through experience, trial-and-error, and observation), judgment, planning, problem-solving, reasoning. These mental abilities can be assessed by administering IQ tests. According to the DSM-5, approximately two standard deviations below the average IQ score (within the range of standard scores from 90 to 109) represents a significant cognitive deficit or disability. Such an IQ score is typically at 70 or below. Generally, such IQ scores occur about 2.5% of the population. In other words, 97.5% of individuals of the same chronological age and culture would score higher. It is important to note that IQ the tests being administered must be standardized and culturally appropriate [6].

(2) Deficits/ impairments in adaptive functioning: It includes skills required for an independent living and ability to perform appropriately and responsibly in activities of daily living (e.g., dressing, feeding and toileting). With limited abilities in these daily life skills, an individual will experience challenges that make it difficult to achieve age-appropriate standards of adaptive behavior. Without these skills, the person needs additional supports to succeed at home, school, or workplace. Functioning deficits in adaptive behavior can be assessed by administering standardized, culturally appropriate tests such as Vineland Adaptive Behavior Scales-Third Edition (VABS-3) [8] and Diagnostic Adaptive Behavior Scale (DABS) [9,10]. Various adaptive behavioral skills that are needed for daily living are as follows:

a) Communication, which refers to the ability to convey information through words and actions from one person to another, and it also requires the ability to understand others as well as to express one's self through words or actions;

b) Social skills that are critical for success in life, and they refer to the ability to interact effectively with others. Such skills include understanding and compliance with social rules, customs, and standards of public behavior, and they require a person's ability to process figurative/metaphorical expressions as well as to detect unspoken cues (e.g., body language, facial expressions, and hand gestures);

c) Personal independence at home or outside, and such skills refer to one's self-care ability, e.g., bathing, dressing, and feeding. It also includes the ability to safely complete day-to-day tasks without guidance, e.g., cooking, cleaning, and laundry. Other routine activities performed in the community include grocery shopping and accessing public transportation.

d) School or workplace functioning, which refers to one's ability to conform to the social standards in class/school or at workplace. This includes one's ability to acquire new content knowledge, skills, and abilities. In addition, this acquired information needs to be applied by the person in a practical, adaptive manner, without excessive supervision, direction or guidance.

(3) All these limitations happen during the developmental period of an individual. In other words, problems with intellectual or adaptive functioning should be evident during childhood or adolescence. If such problems began after this developmental period, the correct diagnosis would be neuro-cognitive disorder (e.g., a traumatic brain injury sustained from a car accident).

According to the AAIDD, CogD is defined as "a condition characterized by significant limitations in both intellectual functioning and adaptive behavior that originates before the age of 22" [7]. Its criteria for diagnostic identification of CogD are:

(1) Intellectual Functioning (also known as intelligence) refers to "general mental capacity such as learning, reasoning, problem solving, and so on. To measure intellectual functioning, an IQ test is

required, and, generally, the IQ score is “around 70 or as high as 75 to indicate a significant limitation in intellectual functioning” [7].

(2) Adaptive Behavior, refers to as a “collection of conceptual, social, and practical skills that are learned and performed by people in their everyday lives”. Below are three subdomains in the adaptive behavior that can be administered by VABS-3 and DABS:

a) Conceptual skills: These include language and literacy skills, concepts such as money, time, and number concepts, and self-direction.

b) Social skills: They are interpersonal skills which include social responsibility, self-esteem, gullibility, naïveté (i.e., wariness), social problem solving, and the ability to follow rules or obey laws, and to avoid being victimized.

c) Practical skills: They refer to activities of daily living (i.e., personal care), occupational skills, healthcare, travel or transportation, schedules/routines, safety, use of money, use of the telephone.

(3) Age of Onset: The condition of CogD must originate during the developmental period, and this is defined to take place before the age of 22 years old [7].

The AAIDD [7] also stresses additional factors, such as community environment typical of the individual’s peers, linguistic diversity and cultural differences in the way people communicate, move and behave, to be considered when assessing ID. Finally, assessments of ID must also assume that “limitations often coexist with strengths’ in an individual, and that the individual's level of life functioning will improve if appropriate, personalized supports are provided over a sustained period.

To guide the conceptual analysis presented in this article, the authors proposed the following two research questions:

a. How can the four subcategories of CogDs, in terms of ‘lexikos’, ‘calculatos’, ‘praxis’ and ‘gnosis’, be conceptually mapped onto the broad abilities of the Cattell-Horn-Carroll (CHC) theory of intelligence?

b. What insights can the CHC framework provide for understanding the cognitive processes underlying developmental and neurological disabilities affecting literacy, numeracy, motor planning, and knowledge acquisition in school-age children?

2. RESEARCH METHODOLOGY

This article adopts a conceptual and integrative literature review methodology to examine the relationship between CogDs and the CHC theory of cognitive abilities. Review articles aim to synthesize existing theoretical perspectives and frameworks in order to generate new insights or reinterpret existing knowledge within a field. In this study, published scholarly literature on CogDs, IDs, neuropsychological processes, and CHC theory was reviewed and analyzed to establish conceptual linkages between the four cognitive subcategories proposed by Chia [11], i.e., ‘lexikos’, ‘calculatos’, ‘praxis’ and ‘gnosis’ as detailed in Table 1, and the broad cognitive abilities identified in the CHC framework.

Table 1. Subcategories of Cognitive Disabilities

Category	**Developmental Disabilities**	**Neurological Disabilities**
Lexikos *(Literacy & language)*	Dyslexia	Alexia

Calculatos *(Numeracy & mathematics)*	Dyscalculia	Acalculia
Praxis *(Motor planning, coordination & execution)*	Dyspraxia	Apraxia
Gnosis *(Knowledge of self & environment)*	Dysgnosia	Agnosia

Relevant academic sources were selected from books, peer-reviewed journals, and established theoretical models in psychology, neuroscience, and special education. The analysis focused on identifying how specific cognitive processes involved in literacy, numeracy, motor coordination, and knowledge acquisition correspond to CHC broad abilities such as crystallized intelligence (Gc), fluid reasoning (Gf), working memory (Gwm), long-term retrieval (Glr), and processing speed (Gs) as detailed in Table 2.

Table 2. CHC-based Broad Abilities

Broad Ability	**What is it?**	**What does it concern?**
Gf	Fluid intelligence	The deliberate but flexible control of attention to solve novel, on-the-spot problems that cannot be performed by relying exclusively on previously learned habits, schema, & scripts
Gc	Crystallized intelligence	The depth & breadth of knowledge & skills valued by one's culture
Gv	Visual processing	The ability to make use of stimulated mental imagery (often in conjunction with currently perceived images) to solve problems
Gwm	Short-term memory	The ability to encode, maintain, & manipulate information in one's immediate awareness
Glr	Long-term storage & retrieval	The ability to store, consolidate, & retrieve information over periods of time measured in minutes, hours, days, & years
Gs	Processing speed	The ability to perform simple, repetitive cognitive tasks quickly & fluently
Ga	Auditory processing	The ability to detect & process meaningful nonverbal information in sound
Gt	Reaction & decision speed	The speed of making very simple decisions or judgments when items are presented one at a time
Gq	Quantitative knowledge	The depth & breadth of knowledge related to mathematics
Grw	Reading & writing	The depth & breadth of knowledge & skills related to written language

In addition to theoretical and conceptual literature, selected empirical studies were also reviewed to examine whether specific CHC broad abilities have been associated with learning disabilities and cognitive processing difficulties in school-age children. Previous empirical findings have demonstrated significant relationships between CHC cognitive abilities such as Gwm, Ga, Gs and Grw [12]. Studies involving children with dyslexia and dyscalculia have similarly reported deficits in phonological working memory, processing speed, and executive functioning that contribute to learning difficulties [13,14]. These empirical findings provide support for the conceptual mapping proposed in this article between the four CogD subcategories and the CHC framework. Through this conceptual mapping, the study aims to provide a clearer theoretical structure for understanding the cognitive foundations of developmental and neurological disabilities affecting school-age children.

The methodological approach is, therefore, both analytical and theoretical, emphasizing synthesis and interpretation rather than empirical data collection. Such an approach is appropriate for exploratory work such as this article that seeks to refine conceptual frameworks and stimulate future empirical research in the field of CogDs and educational assessment.

3. COGNITIVE DISABILITIES: DEVELOPMENTAL & NEUROLOGICAL

CogDs hamper the process of learning, slowing it down as well as interfering with the developing process of an individual. There may be overlapping in defining a developmental and CogD. That is also why the term 'intellectual and developmental disabilities' (IDD) is often used to refer to the same challenging condition. The terms are broad labels that do not indicate the level of ability or skills. Hence, in short, CogD is a nebulous term that describes someone who has more than average difficulty

performing cognitive tasks. CogDs are also considered as the most common disability type among the school-age children.

The challenges of CogDs affect cognitive functioning and learning-related abilities, including academic skills, learning strategies, and self-regulation, thereby interfering with the neuropsychological processes underlying learning, self-awareness, and adaptation to the environment. Figure 1 shows the relationship among the three key factors: (i) cognitive abilities, (ii) neuropsychological processes, and (iii) academic skills.

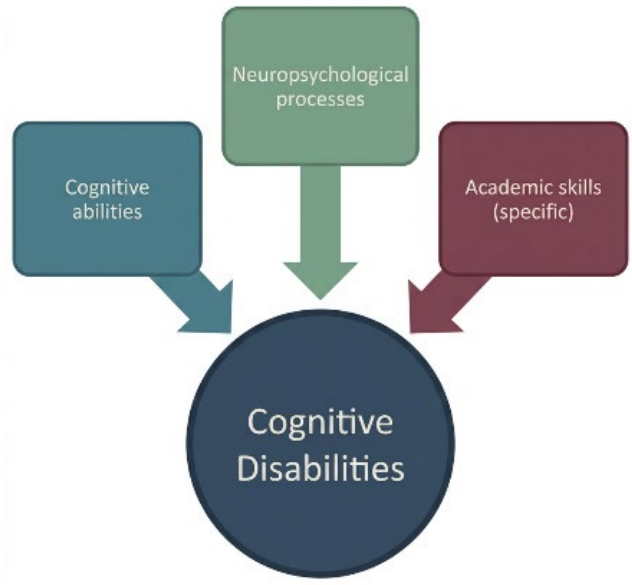

Figure 1. Cognitive Disabilities: Deficits in Cognitive Abilities, Neuropsychological Processes and Academic Skills

The subcategories of CogDs can result in a spectrum of disabilities that fall within either developmental disabilities (DDs) or neurological disabilities (NDs) (Table 1). DDs consists of a diverse group of chronic conditions due to mental or physical impairments whose onset takes place before adulthood. People with DDs experience many difficulties in their lives such as "impairment in physical, learning, language, or behavior areas" [15]. In the United States alone, "about one in six children in the U.S. have one or more developmental disabilities or other developmental delays" [15]. Though persist throughout an individual's lifespan development, DDs can be detected early with appropriate standardized assessment tools such as IQ tests and development screeners. If DD affects two or more areas of a child's development, the condition is often referred to as global developmental delay with the diagnostic code of EI-DD (if it is detected earlier between birth and 3 years of age) or PS-DD (if detected between 4 and 6 years of age) according to the Educator's Diagnostic Manual (EDM) [16]. Figure 2 shows a diagrammatic representation of all the developmental and neurological disabilities of CogDs.

In this article, the authors have chosen to describe each of these four subcategories of CogDs by relating them to the CHC framework of broad and narrow abilities, when Cattell proposed his original conceptualization of intelligence in 1940s [17] based on the dichotomous understanding of cognitive ability referred to as fluid-crystallized theory or Gf-Gc theory. On one hand, the Gf includes inductive and deductive reasoning abilities, which are "influenced by biological and neurological factors as well as incidental learning through interaction with the environment" [18,19].

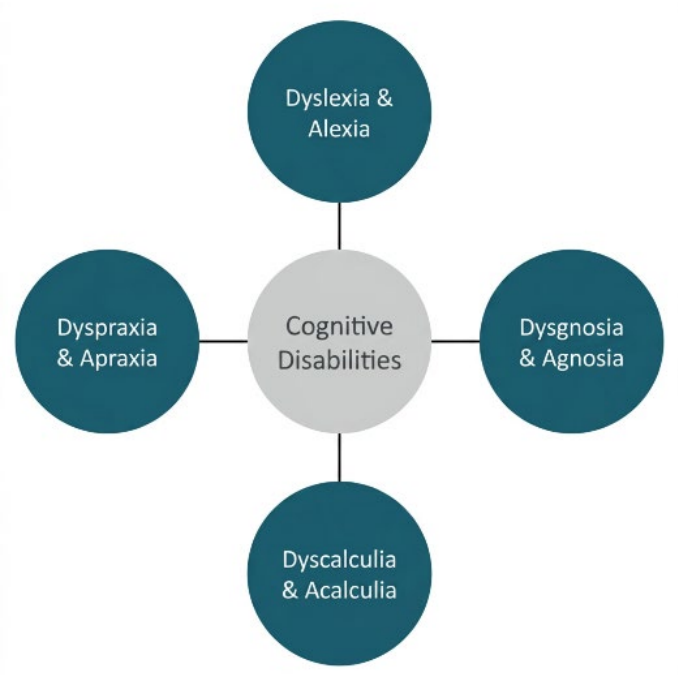

Figure 2: Four Subcategories of Cognitive Disabilities

The CHC framework of human potential (or cognitive abilities) is more than just Gf-Gc theory. In 1965, John Horn later expanded the dichotomous model to include four more abilities, i.e., Gv, GWM, Glr and Gs as detailed in Table 2. Subsequently in 1967, Horn added and refined the definitions of Ga, Gv, Gs and Glr. He and Stankov added Gt, Gq and Grw in 1991 and 2000 respectively and expand the CHC to a 10-factor model [17,20-22].

4. SUBCATEGORIES OF COGNITIVE DISABILITIES

The following sections present a conceptual mapping of the four subcategories of CogDs within the framework of the CHC theory of cognitive abilities. Each subcategory is examined in relation to relevant CHC broad abilities to illustrate how specific cognitive processes underlying literacy, numeracy, motor coordination, and knowledge acquisition may contribute to learning difficulties in school-age children.

4.1 Cognitive Abilities #1: Lexikos

There are two key specific learning disabilities that are concerned about literacy and language. The first one is the disability of reading known as dyslexia, while the second one is the disability of writing known as dysgraphia. In some ways, both are related to each other in terms of literacy process and product [23].

Dyslexia is “a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge” [24]. People with brain lesions have been found to have difficulties in literacy and language processing and this condition is known as alexia [25].

Empirical studies have consistently shown that individuals with dyslexia demonstrate deficits in phonological working memory, processing speed, and auditory processing, which correspond closely to CHC broad abilities such as Gwm, Gwm, Gs, and Ga. For example, De Carvalho et al. [26] found that students with dyslexia exhibited weaker phonological working memory and reading fluency compared to typically developing peers. Similarly, de Oliveira et al. [27] reported slower naming speed and reduced word recognition abilities among children with dyslexia, highlighting the role of processing speed and phonological processing in literacy difficulties. More recently, Wang et al. [28] demonstrated behavioral and neurophysiological differences in verbal and visual working memory among children with dyslexia, further supporting the relationship between working memory deficits and reading disabilities. CHC broad abilities for reading include Ga, Gc, Glr, Grw, Gs, Gwm, Gt (see Table 2) [17].

There is another specific learning disability to do with deficits in writing deficits, and it is known as dysgraphia. Berninger (2020) has defined dysgraphia as "a specific learning disability that affects how easily children acquire written language and how well they use written language to express their thoughts … [d]ysgraphia is the condition of impaired letter writing by hand, that is, disabled handwriting and sometimes spelling. Impaired handwriting can interfere with learning to spell words in writing … Dysgraphia may occur alone or with dyslexia (impaired reading disability) or with oral and written language learning disability. If writing problems are the result of neurological impairments, the condition is known as lexical or orthographic agraphia [29]. CHC broad abilities for writing include Ga, Gc, Gf, Glr, Grw, Gs, Gwm, Gt, Gv.

4.2 Cognitive Abilities #2: Calculatos

Dyscalculia concerns poor number sense and faulty skill in subitizing (i.e., "instantly seeing how many") and it refers to difficulty learning or comprehending arithmetic, e.g., problems in understanding and manipulating numbers, difficulties in performing mathematical calculations and trouble in acquiring mathematical facts [30]. It is often mistaken for what is known as math dyslexia, but such a term is misleading as dyslexia is a different condition from dyscalculia. Disabilities in learning mathematics can also be the result of some types of brain injury, and it is termed acalculia [31] rather than called dyscalculia, which is of innate, genetic or developmental origin.

Research evidence also supports the relationship between mathematical learning disabilities and CHC cognitive abilities. Moll et al. [13] found that children with mathematics disorders demonstrated weaknesses in visuospatial working memory and temporal processing, while López-Resa and Moraleda-Sepúlveda [14] reported that children with dyscalculia showed poorer performance in tasks involving stimulus integration and mathematical text comprehension. These findings suggest that deficits in working memory, processing speed, and quantitative reasoning abilities may contribute significantly to difficulties in numeracy and mathematics learning. CHC broad abilities for numeracy and mathematics: Gc, Gf, Glr, Gq, Gs, Gwm, Gv, Gt.

4.3 Cognitive Abilities #3: Praxis

"Developmental coordination disorder (DCD), also known as developmental dyspraxia or simply dyspraxia, is a neurodevelopmental disorder characterized by impaired coordination of physical movements as a result of brain messages not being accurately transmitted to the body". Interestingly, praxis has also to do with phenomenal will, also known as self-agency, which is the sense that actions are self-generated [32,33]. Wegner [34,35] later defined the three criteria of self-agency: (i) priority, (ii) exclusivity, and (iii) consistency. Priority refers to a planned action before its initiation. Between the initiated action and the subsequent effect is that time interval known as the intentional binding. Next, exclusivity refers to the effect due to an individual's action instead of other potential causes for the effect. Lastly, consistency refers to one's planned action that must happen as intended. It is not within the scope of this article to discuss the topic in-depth.

Deficits are noted in fine or gross motor skills movements in an individual with DCD and they interfere with activities of daily living. Often described as the disorder in skill acquisition, learning as well as execution of coordinated motor skills, when assessed, is found to be substantially below that expected of the individual's chronological age. Difficulties in dyspraxia include clumsiness, slowness and inaccuracy of performance of motor skills (e.g., untidy handwriting which is also described as cacographia, clumsy in handling cutlery or using tools). DCD or dyspraxia is also accompanied by challenges in organizing, paying attention, time management, and working memory. Problems in motor-related activities due to brain injuries are often identified as apraxia [36,37].

The authors have selectively included the following CHC broad abilities, which they believe are related to movement and coordination: Gp, Gs, Gwm, Gv, Gt (Table 2).

4.4 Cognitive Abilities #4: Gnosis

Dysgnosia is a cognitive disorder relating to any mental illness. The term comes from the Greek word 'gnosis' which means 'knowledge' [38-41]. The authors of this article chose to define dysgnosia as a form of cognitive impairment in two aspects of knowledge: (i) The first aspect concerns the knowledge of self (i.e., self-awareness or being mindful of oneself and one's actions) and that includes self-activated tasks, especially in self-agency (also known as the phenomenal will), which is the sense that actions are self-generated [34,35]; and (ii) The second aspect concerns the knowledge of one's surrounding or context, in which one's action, utterance, or expression can only be understood relative to that context [42].

Libet et al. [32] discovered that brain activity predicts the action before one even has conscious awareness of his or her intention to act upon that action. Jaynes [43] argued that the human mind used to operate in a way that cognitive functions in the brain were divided between that 'which speaks' and that 'which listens and obeys'. He termed it the 'bicameral mind', from which his hypothesis of bicameral mentality (or the sense of bicamerality of the unconscious mind) came about. He argued that the evolutionary breakdown of this division gave rise to human consciousness and also pointed out that bicameral mentality was the normal and ubiquitous state of the human mind. If this were indeed the case, our understanding of gnosis and also of agnosis (i.e., ignorance) should go beyond what is currently presented here. If the condition of knowledge acquisition deficits is a result of some form of brain injury, it is known as agnosia, which is the inability to process sensory information, i.e., it includes severe to profound mental retardation [44].

It is important not to confuse between the two terms: agnosis and agnosia. The former refers to ignorance while the latter is a serious disability. Often there is a loss of ability to recognize objects, persons, sounds, shapes or smells [45-49] while the specific sense is not defective nor is there any significant memory loss. The authors have selectively included the following CHC broad abilities, which they believe are closely related to knowledge acquisition: Ga, Gf, Gkn, Glr, Gq, Grw, Gwm, Gt (Table 2).

In addressing the two research questions proposed earlier, this article has shown how the four subcategories of CogDs can be conceptually mapped onto the CHC framework of cognitive abilities and how this framework offers insights into the cognitive processes underlying developmental and neurological learning disabilities in school-age children.

By aligning these conditions with CHC cognitive abilities, this article illustrates how cognitive deficits in specific domains may explain learning difficulties observed in school-age children.

5. IMPLICATIONS FOR PRACTICE IN EDUCATIONAL THERAPY

The conceptual mapping four subcategories of CogDs onto the CHC theory of intelligence provides educational therapists with a more precise, cognitively grounded approach to assessment and intervention. Rather than focusing only on observable academic difficulties, educational therapists can interpret learners' challenges in terms of underlying CHC broad abilities. This enables more accurate differentiation between learners with similar presenting difficulties but distinct cognitive profiles, supporting hypothesis-driven assessment and individualized intervention planning [17,50]. Such a CHC-informed approach also strengthens psychoeducational assessment practices by enabling practitioners to identify specific cognitive processing deficits underlying academic difficulties rather than relying solely on global IQ scores or observable classroom performance.

Contemporary assessment models increasingly advocate the use of cross-battery and CHC-based assessments to guide evidence-informed diagnostic decision-making and educational planning for learners with diverse cognitive profiles [17,51]. Interventions can thus be designed to target root cognitive processes (e.g., phonological training for deficits in auditory processing or scaffolded strategies for working memory limitations), leading to more effective and transferable learning outcomes across domains. For example, interventions targeting phonological processing, processing speed, and working memory have been shown to improve literacy and numeracy outcomes among children with specific learning disabilities when aligned with learners' cognitive strengths and weaknesses [52,53]. This reinforces the importance of individualized and cognitively responsive intervention strategies grounded in empirically supported frameworks.

Empirical evidence further supports the usefulness of the CHC framework in psychoeducational assessment and intervention planning. Cormier and team [12] demonstrated that broad CHC abilities such as Gf, Ga, Gs, and Gwm significantly predict reading achievement among school-age children. More recently, Radtke et al. [54] found that children and adolescents with dyslexia displayed significant weaknesses in Gc, Gv and Gwm when assessed using CHC-based intelligence measures. In addition, Chia (2026) has identified several narrow abilities of Gv and Ga that are implicated in dyslexia, such as Gv-MV and Gv-P, as well as Ga-US, Ga-UR and Ga-UM. These findings reinforce the practical value of using CHC theory to guide educational therapy, individualized intervention planning, and cognitive assessment practices.

Moreover, the CHC framework strengthens interdisciplinary collaboration and supports evidence-informed practice. As it is widely used in psychoeducational assessment, the framework provides a shared language for educational therapists, psychologists, and educators to interpret cognitive profiles and align intervention strategies [50]. This promotes more integrated and consistent support for learners across settings. Furthermore, grounding practice in CHC theory encourages systematic decision-making and ongoing professional reflection, enabling therapists to evaluate intervention effectiveness in relation to specific cognitive constructs.

At the policy level, the integration of CHC-informed assessment and intervention approaches is consistent with inclusive education frameworks that emphasize individualized support, early identification, and equitable access to educational opportunities for learners with disabilities [55]. Such cognitively informed frameworks may also support multidisciplinary collaboration and evidence-based educational policies aimed at improving long-term learning and adaptive outcomes for school-age children with CogDs.

6. CONCLUSION

This article examined the relationship between four sub-categories CogDs and the broad abilities described in the CHC theory of intelligence. The analysis presented in this article demonstrates that the CHC framework provides a useful theoretical lens for understanding the cognitive processes

underlying developmental and neurological disabilities affecting literacy, numeracy, motor coordination, and knowledge acquisition in school-age children. By conceptually mapping these four subcategories onto relevant CHC broad abilities, the discussion highlights how specific cognitive processes, such as Ga, Gwm, Gs and Gv, may contribute to learning difficulties observed in educational contexts. This framework therefore offers educators, psychologists, and educational therapists a structured way to interpret and support diverse learning needs. Future research may further examine the applicability of this conceptual mapping through empirical studies and explore its implications for assessment, intervention, and educational practice.

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8. COMPETING INTERESTS

The authors have declared that no competing interests exist.

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10. ARTIFICIAL INTELLIGENCE DISCLOSURE

No AI writing or generative tools were used in the preparation of this manuscript.

11. DATA AVAILABILITY STATEMENT

Not applicable. No primary data were generated or analysed in this study.

12. ETHICS APPROVAL

Not applicable. This study did not require ethics approval.

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