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Understanding the Neurological Framework of ADHD Using the Griffiths III: A Case Study

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Abstract

There is a multiplicity of difficulties when faced with decisions about ways to support children with Attention-Deficit/Hyperactivity Disorder (ADHD) (Baker, 2008). This article highlights the use of the *Griffiths Scales of Child Development, 3rd Edition* (Griffiths III), a normed developmental measure, as well as the *Conners* 3: *Parent and Teacher Survey—Long Form*, to assist with the decision of whether to use medication to assist a 5-year-old girl with ADHD. The Griffiths III indicated a developmental delay on all five domains measured, warranting the need for therapeutic interventions. The information gleaned from the measures was used to assist with the decision to use stimulant medication to support this young child. This case illustrates the use of the Planning, Arousal, Simultaneous and Successive (PASS) model of cognitive processing and showed how this model might assist in understanding the difficulties experienced to guide interventions in her specific context.

Keywords

Attention-Deficit\Hyperactivity Disorder, Griffiths III, PASS Model, Executive Functions

1. Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most common neurodevelopmental disorders in childhood and the manifestations thereof negatively affect a child's overall development and warrant the need for therapeutic interventions as soon as the problem is identified (Acquiar, Eubig, & Schantz, 2010). The question then is to establish whether an ADHD diagnosis should only be the domain of a pediatrician or whether other healthcare professionals should

be involved. To answer this question, it should first be noted that ADHD is conceptualized by the *Diagnostic and Statistical Manual of Mental Disorders,* 5th *Edition* (DSM-V) as a neurodevelopmental disorder. This disorder is included under the category as the following disorders namely, autism spectrum disorder (ASD), communication disorders, intellectual disability, specific learning disorders, and motor disorders (American Psychiatric Association, 2013). These conditions are understood to be a result of abnormalities of typical brain development which are characterized by the following factors namely, 1) early onset during childhood often accompanied by neurocognitive deficits; and 2) a stable progression over time (Thapar, Cooper, & Rutter, 2016).

ADHD comprises deficits in executive functioning skills that are understood as a singular construct with three separate skills which include, working memory, inhibitory control, and cognitive flexibility (Miyake et al., 2000). Higher-order skills such as problem-solving, creativity, and planning require the ability to retain cognitive information despite distracting extraneous variables, together with the ability to vacillate between different rules and mindsets (Diamond & Lee, 2011). The above-mentioned functions are reliant on the prefrontal cortex (Bolton & Hattie, 2017). Executive function is, thus used to describe cognitive functioning that highlights uninterrupted development into young adulthood (Diamond, 2013; Miyake et al., 2000). In particular, executive functions encompass constructs such as thinking, organizing, problem-solving, memory, attention, and movement—all of which impact the ADHD child's cognitive functioning (Diamond, 2013). Other affected areas of development are emotion recognition (Waddington et al., 2020), fine motor skills (Meyer & Sagvolden, 2006); motor imagery (Lewis, Vance, Maruff, Wilson, & Cairney, 2008), motor planning (Dahan & Reiner, 2017), gross motor skills, and graphomotor skills (Tseng, Henderson, Chow, & Yao, 2004).

While the etiology of ADHD is poorly grasped by different medical and health care professionals, however neurotransmitter (e.g., dopamine, noradrenaline, and serotonin) transmission is believed to bear importance thereto, with several of these having demonstrated replicable evidence of association (Mehta, Monegro, & Nene, 2019). Additional causes, but to a lesser extent, include maternal alcohol abuse during pregnancy, low birth weight, nutritional deficiencies, and early psychosocial adversity (Bellman, Byrne, & Sege, 2013). Heredity has further been reported to play a prominent role (Verkuijl, Perkins, & Fazel, 2015).

There are many causes of ADHD, and treatment has triggered several debates with respect to and amongst health, education, media, and the public (Verkuijl et al., 2015). This discourse has left many parents in South Africa not knowing where to turn when they suspect that their child has ADHD as there is a lack of awareness and knowledge in their communities (Goldilocks and the Bear Foundation). ADHD is a neurodevelopmental condition, it can affect a child cognitively, socially, psychologically, and emotionally (Boivin et al., 2015). This disorder can also negatively impact a family's well-being (Boivin, Kakooza, Warf,

Davidson, & Grigorenko, 2015). If medication is the only intervention, without containment by other interventions—both at home and in the school environment—or by different healthcare professionals, it could impact a child's present and future functioning. The question then needs to be asked: Which professional(s) should take responsibility for a child with an ADHD diagnosis, and what intervention strategies should be implemented to best serve the child at a particular moment in his or her developmental journey?

This article, thus, describes the cognitive, social, and behavioral deficits of a 5-year-old preschooler with ADHD. The case study approach has been employed to highlight the effectiveness of the *Griffiths Scales of Child Development, 3rd Edition* (Griffiths III; Green et al., 2016), a normative developmental assessment measure when used as a tool to assess developmental domains. Griffiths III is a comprehensive, child-friendly measure that assesses the five avenues or domains of learning, namely, Foundations of Learning, Language and Communication, Eye and Hand Coordination, Personal-Social-Emotional Skills and Gross Motor. An overall level of development can be obtained with Griffiths III, along with developmental levels in each of the domains assessed. The items in the measure were standardized against a sample of typically developing children from birth to the age of 72 months. Insights into the results of the assessment indicate how such tools might be used to identify deficits and, thereby, guide interventions to strengthen the "building blocks" needed for scholastic progress. Guidance for the choice of interventions and involvement of other professionals is one of the key goals of the assessment.

Before describing the case, the literature review, presented next, highlights the necessity for screening and assessing preschoolers as a starting point for intervention approaches.

2. Literature Review: Assessment of Preschool Children

Assessment for ADHD in early childhood incorporates different processes, including identification (surveillance), screening, and assessment (evaluation) (Groth-Marnat & Wright, 2016). In-depth assessment is a more comprehensive form of assessment as it aims to refine screening and provide in-depth information that can be utilized to make a suitable diagnosis and aid intervention (Groth-Marnat & Wright, 2016). Several authors have highlighted that developmental assessments should be executed by professionals. Developmental assessments involve a child's functioning being compared with their chronological age with regards to areas such as social, emotional, and cognitive domains (Grantham-McGregor, Cheung, Cueto, Glewwe, Richter, & Strupp, 2007). These types of assessments provide information regarding a range of developmental areas particularly those that measure cognitive, language, fine and gross motor functions, and socio-emotional competencies (Bellman et al., 2013).

Results from assessment measures serve as a guide for therapeutic interventions and are not merely utilized for placement in alternative educational set-

tings (Johnson & Marlow, 2006). Furthermore, normative assessment that is empirically and conceptually grounded in developmental models, together with early intervention, offers a systematic way to maximize a child's potential and provide support for vulnerable children (Guralnick, 2011). For preschool assessment to guide interventions, there must be 1) a purpose for administering the test and the rationale for selection of the assessment measure, 2) a clear theory underpinning the results, 3) an indication of areas of need, and 4) a clear plan of action (National Research Council, 2008). In general, there is widespread agreement on the part of educators and other early childhood specialists that the broad goal of preschool assessment needs to maximize the improvement of learning experiences despite manifestations caused by delays and disabilities (Yoshikawa, Weiland, & Brooks-Gunn, 2016). In-depth assessment aims at providing prognostic information and allows for specific and appropriate early childhood therapeutic interventions by identifying specific developmental disorders and delays.

Children with neuropsychological developmental delays have been further found to present with associated problems that require multidisciplinary interventions and identification (Boivin et al., 2015). Results on assessments can provide a baseline for assessing a child's performance over a period and thus allowing professionals to observe and trace a child's performance by regularly comparing it with the initial performance. The results can then be used to determine which educational strategies would be most beneficial to the child (National Research Council, 2001).

Overall, assessments provide a record of growth in the developmental areas of cognition, language; eye and hand coordination; and motor, social, and emotional domains Assessments also identify children who need additional support and can be used to determine what individualized instruction and additional therapies might be needed to promote progress (National Research Council, 2008).

3. Method: Case Study Research

The case study method falls within the scope of Creswell (2007) qualitative research model. According to Fidel (1984), this method aims to arrive at an understanding of the event being studied to develop more general theoretical facts about uniformities of observed phenomena. Case studies are utilized to gain an in-depth understanding when there is a limited sample of individuals, situations, or problems (Patton, 1992). Qualitative and quantitative data can be used to provide the foundation of a case study (Yin, 2013).

Based on this understanding, a case study method was employed in this current study to arrive at a comprehensive understanding of the assessment, conceptualization, and intervention of a 5-year-old girl using the Griffiths III. The purpose was, as per Patton (1992), to gain deeper insights and understanding when researching one individual within a specific context. This approach was taken to isolate features that refer to several cases and highlight those that are

case-specific while simultaneously being common in all cases, as per recommendations by Struwig and Stead (2001). Due to the adoption of this approach, the information from the case study cannot be generalized but can still highlight how the Griffith III might be used to better understand and interpret the functioning of an ADHD preschool child, with a view to initial intervention strategies.

4. Background to the Assessment

4.1. Lilly's Environment

Lilly (pseudonym) is a 5-year-old girl (60 months) who comes from a middle-class family. She is an only child. Lilly currently attends preschool. Both of Lilly's parents work, which necessitates her attendance at an aftercare facility in the afternoon. Since the Covid-19 pandemic has recently interrupted schooling, her grandparents look after Lilly from time to time. The reason for her referral was that the preschool is reluctant to take her back unless she is placed on medication for her hyperactive behavior and behavioral symptomatology, which are both aggressive and disruptive, and have led the parents of other children to complain to the school about her. Lilly's parents are, however, reluctant to contemplate putting her on medication at such a young age.

4.2. Lilly's Developmental and Medical History

The following collateral information regarding Lilly's development and current level of functioning was gleaned from interviews with both parents and her current class teacher, along with the information obtained from the assessment measure, namely the Griffiths III. Lilly's parents indicated that there is a history of ADHD on the father's side of the family, with two of his three siblings having been diagnosed. In both the siblings' cases, ADHD resulted in diminished academic achievement.

Although her birth was without complications, Lilly was a colicky baby. Her parents also mentioned that there were significant delays in some of her milestones. For example, Lilly only began walking at 15 months. Her language competencies were also somewhat delayed, with Lilly only beginning to use two-word utterances after the age of two. Her bladder and bowel control were, however, found to be normal, and her parents reported that Lilly has had no medical history requiring hospitalization.

4.3. Lilly's Behavior

Both Lilly's parents stated that their biggest challenge is that Lilly "shoots from the hip" without thinking. Specifically, her parents noted that Lilly is aware of right from wrong and demonstrates remorse, but only after aggressive behaviors have been exhibited. They further remarked that Lilly presents with chaotic daily living practices and tends to eat sweets while simultaneously brushing her teeth. Furthermore—both at home and at school—Lilly tends to talk over others, and if

she does not get her way, tends to resort to attention-seeking behaviors like shouting, hitting, and crying.

Lilly was also indicated as having a short fuse—exploding with limited provocation. Her teacher further highlighted Lilly is socially clumsy and loses focus, especially when tasks involve pencil and paper activities. Lilly's "happy place" is when she plays computerized games on her iPad. When engaging in this type of task, Lilly can focus and complete the activity. The teacher further reported that Lilly's overall learning process is slow.

4.4. Assessment Battery

Based on the collateral information from the preschool teacher, parents, and screening, a normative test battery was selected.

4.4.1. Conners 3: Parent and Teacher Surveys—Long Form

Lilly's mother completed the parent version while her teacher reported on Lilly's behavior using the teacher version of the *Conners* 3: *Parent and Teacher Surveys—Long Form* (Conners 3) rating scale questionnaires established by Conners in 2008. This screening tool aids to identify ADHD/ADD manifestations and indicates an individual's difficulties in both the attentional and behavioral domains (Conners, 2008). Therefore, this measure was used as part of the test battery, as Lilly presented as highly distractible and was unable to complete tasks, both at home and at school. Domains of functioning assessed on this measure include inattention, learning difficulties, executive functioning, patterns of behavior, hyperactivity/impulsivity, and peer interaction (Conners, 2008). Furthermore, with regards to behavior, the Conners 3 also identifies possible symptoms of Conduct Disorder and Oppositional Defiant Disorder (ODD). The results on these scales obtained indicated that Lilly meets the diagnostic criteria for ADHD: Combined Presentation (ADHD-C, i.e., meets both inattentive and hyperactive/impulsive criteria).

4.4.2. Griffiths III Scales of Child Development, 3rd Edition

The Griffiths III scales were utilized to evaluate Lilly's current developmental functioning, as per (Green et al., 2016). This normative measure assesses across five subscales (A-E), namely A) foundations of learning, B) language and communication, C) eye and hand coordination, D) personal-social-emotional, and E) gross motor domains (Green et al., 2016). The measure also provides an individual profile across the domains and determines whether a child is developing age appropriately or presents with a general or specific delay in certain areas of development (Green et al., 2016). This current article, thus, sought to support the interpretation of the child's level of developmental functioning to inform a way forward using Lilly's strengths and weaknesses, as determined by the scores obtained on this measure. An outline and description of subscales A-E are discussed in the following paragraphs.

Subscale A: The first subscale assesses critical aspects of learning during

childhood and forms the foundation for successful learning. Specifically, this subscale assesses the following constructs: 1) skills of learning, 2) ways of thinking, and 3) memory and 4) play which all form a crucial foundation for cognitive development (Green et al., 2016). In addition, aspects assessed on this scale include cognitive skills for learning, such as attention and processing speed; as well as executive skills, such as flexibility, curiosity, and creativity. The subscale also assesses reasoning, the organizing of information, and planning; concept formation and critical and analytic thought, sequencing, matching, sorting, and pattern making; and various types of memory and object permanency. Play by means of which the child is guided to engage with concrete objects in a creative way is also assessed (Green et al., 2016).

Subscale B: This second subscale evaluates a child's general development of speech and language abilities, which includes both the understanding and general use of language and, to a lesser extent, the use of language to interact socially. This subscale also measures the development of language from pre-linguistic communicative intent to receptive and expressive understanding of single words and incrementally progressing to the understanding and use of complex grammatical concepts (Green et al., 2016). In addition, the subscale assesses underlying the competencies necessary for the successful acquisition of language, and includes items that focus on attention, listening, and verbal memory.

Subscale C: This subscale has been developed to assess a child's 1) visual perceptual, 2) fine motor, and 3) manual dexterity skills. Constructs within this subscale include visual perception, fine motor coordination, motor planning and bilateral coordination, object manipulation, graphomotor skills, complex constructional skills, speed of movement, and pencil grip (Green et al., 2016).

Subscale D: This subscale comprises constructs that assess personal, social, and emotional aspects of a child's overall development. The personal subconstructs contain items that measure personal information and a child's levels of independence in daily living skills. The social subconstructs on this scale measure a child's interactions, joint attention, humor, and play. The emotional subconstructs include items that evaluate attachment, moral reasoning, and emotional understanding and regulation (Green et al., 2016).

Subscale E: This final subscale is the gross motor scale and assesses a child's early development in respect of 1) postural control, 2) gross body co-ordination, 3) visual-spatial coordination, 4) balance, 5) rhythm, 6) motor sequencing, and 7) power, and strength (Green et al., 2016).

5. Results

Considering Lilly's overall results of the Griffiths III, it was possible to see that she falls within the borderline range. These results are depicted in **Table 1**, which indicates Lilly's developmental functioning across all five previously noted domains.

Table 1. Results of the Griffiths III.

ASSESSMENT RESULTS							
	Raw Score	Developmental Age (Months)	Scaled Score	Development Quotient (DQ)	95% CI of DQ	Percentile	Stanine
Subscale A	51	53	7	88	88	22	4
Subscale B	53	48	6	76	76-77	7	2
Subscale C	54	50	7	83	83	14	3
Subscale D	53	46	4	65	63-67	2	1
Subscale E	49	44	4	64	63-65	2	1
General Development (GD)	52	48	4	66	64-68	2	1

The base rates for the various subscale scaled score differences confirm that Lilly does not demonstrate any significant differences between her scores on individual subscales and that the use of the General Developmental Quotient is appropriate. Broad knowledge regarding Lilly's performance across the developmental domains has, thus, been reached. However, for effective intervention to occur, it remains necessary to examine the constructs assessed within these domains that were not achieved.

6. Discussion

On Lilly's foundations of learning subscale, her slow processing speed led to reduced performance on timed items. Lilly's focused attention was found to be adequate, but both her sustained and selective attention spans were severely compromised and affected the delayed recall of information. Lilly's poor attention also affected both her immediate and delayed memory functions. Based on these results, it was difficult to identify the primary deficits, as poor attention leads to poor processing and the inability to recall both visual and auditory information from memory. Lilly did, however, show fluctuations that were better when handling concrete objects in comparison to performing pencil and paper tasks. Spontaneous play was absent, except for games Lilly played on the computer.

In respect to Lilly's language and communication subscale, constructs not achieved included auditory memory, sequential processing, conceptual language abilities, and attention. Of note was that Lilly was unable to repeat a 10-word sentence or numbers read to her. Lilly also struggled to follow longer instructions (e.g., "put the pencil on the floor and then put the dog on the brick"). Aside from these findings, Lilly's language skills were determined to be concrete, with her exhibiting sufficient language to communicate effectively. However, when conceptual aspects of language were required, such as naming opposites and/or understanding differences, Lilly was unable to complete the items. Lilly

also struggled to describe actions in a big picture, resorting instead to one or two words with no further description or full sentences.

Lilly's performance on the eye and hand coordination subscale confirmed difficulties in graphomotor tasks that require the manipulation of a pencil, including copying and drawing. Poor pencil control was evidenced in all Lilly's pencil and paper tasks. Lilly did, however, manage items that could be manipulated concretely, including buttoning and unbuttoning buttons of different sizes. In addition, Lilly was able to correctly use two screws to put together pieces of a constructional toy in an age-appropriate way. However, Lilly did not achieve the related higher-level task that requires more motor planning. Lilly was also unable to use universal scissors or manage other tasks requiring bilateral coordination, such as folding a paper square. A further finding was that Lilly tends to be tactile defensive and refused to touch the play dough.

On the personal-social-emotional subscale, Lilly was found to be able to partake in basic self-care in an age-appropriate manner. However, Lilly presents with an inability to manage frustration, often responding by having "meltdowns". In their interviews, both Lilly's parents and her teacher reported poor peer interaction and generalized aggressive retaliation towards perceived challenges. However, in respect to the tasks linked to her socio-emotional development, such as perspective taking, moral reasoning as well as empathy, Lilly did show age-appropriate development. Despite such findings, Lilly's ability to identify emotions was found not to be age appropriate.

On the gross motor subscale, Lilly's power and strength were found to be appropriate for her age. However, Lilly exhibited difficulties in all tasks requiring motor planning, sequencing, and balance. Lilly was also unable to copy the examiner (e.g., crossing her feet and knees when seated), which would have already been an age-appropriate skill at the age of 2-and a half. Of further note is that Lilly was unable to catch a short tennis ball thrown from a short distance away; neither could she stand on one leg for 10 seconds, walk along with a 1.5-metre tape, or make three-star jumps in a sequence.

As a means of better understanding Lilly's current functioning, the Planning-Arousal-Simultaneous-Successive (PASS) model of cognitive processing developed by Naglieri and Das (1987, 1988) has been presented in **Figure 1**.

The figure depicting the processes of the PASS model indicated above succinctly describes the cognitive processes identified in Luria's (1966, 1973, 1980) theory. According to Luria (1966, 1973, 1980), cognitive processing consists of three interrelated functional systems, namely the units of arousal and attention, information coding, and planning. In the first stage, the arousal unit develops, and damage to the brain at this crucial stage can lead to hyperactivity and/or attention deficits that interfere with the learning process. The PASS theory has proven useful for both intellectual assessment and educational intervention. (Das, Naglieri, & Kirby, 1994). The first process is that of Planning which is a frontal lobe function and is responsible for controlling and organizing higher

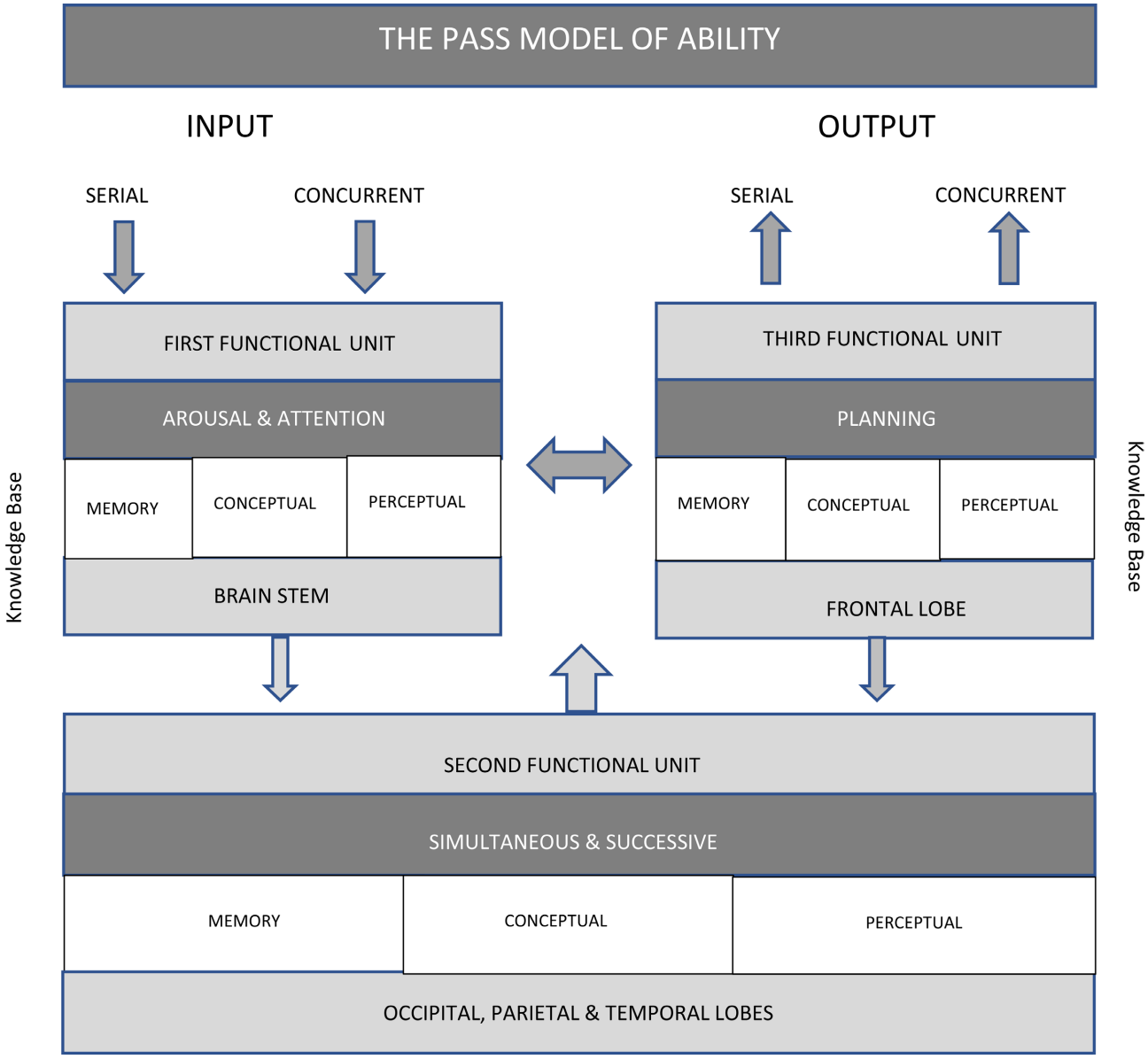

Figure 1. PASS model (Das, Naglieri, & Kirby, 1994).

level executive functions, behavior, as well as monitoring of performance. The second process is that of Attention which is necessary for maintaining arousal and ensuring focus and is a task of both the frontal lobe and the subcortical parts of the brain. Simultaneous and successive processing which follows the Attention process is necessary for the organization of information into coherent whole. Lastly, the fourth process is that of Successive processing, and important for the assembling of information in a specific order, where each element is related to the element that precedes it. Both Successive and Simultaneous processing occur in the posterior region of the brain.

In the first stage, the arousal unit develops, and damage to the brain at this crucial stage can lead to hyperactivity and/or attention deficits that interfere with the learning process. During the second stage, the information coding unit rece-

ives analyses and stores sensory data from the internal and external environments. During the information coding stage, the brain begins to foster the attainment of storage and retrieval of knowledge through simultaneous and successive processes which form part of the PASS model theory (Das, Naglieri, & Kirby, 1994). The three lobes namely, parietal, temporal and occipital lobes are all components of the information coding unit which includes the primary sensory and motor areas, such as touch, sight, hearing, and movement development. During the third stage, the planning unit is involved and provides the individual with the means to analyze cognitive activity and develop a way of solving the problem, as well as evaluate the effectiveness of the solution (Das, Naglieri, & Kirby, 1994) These processes are elaborated on in terms of Lilly's functioning in the following paragraphs.

Attention is the first step in the processing of information and is necessary for sensory data to be registered in the cortex. For such registration to occur, an appropriate level of arousal and attention must be maintained. Furthermore, sustained attention is vital for the effective processing of information and formulating complete plans of action (Luria, 1966, 1973, 1980). When analyzing Lilly's performance, it was noted that her focused attention, which is the most basic form of attention, appeared intact, as she was able to respond to short instructions. However, Lilly's sustained attention was dependent on her level of interest and competency. Lilly was further found to be able to play computer games and watch television for longer periods of time when compared to other activities. It needs to be noted, then, that when a visual component is part of an activity, Lilly's performance tends to improve when provided with a "hand-on" task with a visual component. When evaluating Lilly's sustained attention, especially when it pertained to verbal input, (i.e., the ability to maintain attention until a task is completed), it was found to be poorly developed, as was her selective attention (i.e., the ability to maintain a cognitive mindset despite competing distractions). This lack of selective attention is particularly evident in the classroom, where Lilly seldom completes tasks and tends to flit from one activity to another as she has difficulty maintaining her arousal levels. Too much or too little arousal interferes with coding and planning (Das, Naglieri, & Kirby, 1994). This is so when evaluating Lilly's fluctuations in her attention levels; the more complex the task, the weaker she performs.

Lilly also struggles with both alternating and divided attentional skills and is unable to shift her attention to various aspects of one task, or to simultaneously divide attention between two tasks. Furthermore, Lilly was found to be unable to concentrate on tasks when there is a high level of noise. She is also reluctant to partake in interactive games, possibly due to her deficits in simultaneous attention and poor peer interactions.

The four characteristics that are prevalent in ADHD are 1) inattention, 2) impulsivity, 3) hyperactivity, and 4) distractibility—all of which fall into the *arousal and attention* unit. The second unit of the PASS model describes the *si-*

multaneous and *successive* processing of information from sensory input once it has reached the cortex (Naglieri, Das, & Goldstein, 2012). Normally, the stimuli with which a child must contend is bundled in either a serial or simultaneous order for it to be maintained (Naglieri, Das, & Goldstein, 2012). In this regard, constructs on the Griffiths III that tap simultaneous cognitive processing posed difficulties for Lilly, as many of the deficits she showed in the visual-spatial realm are the result of defective simultaneous processing.

On the eye and hand coordination subscale, Lilly struggled to place twelve pegs in a pegboard, 6 clothes pegs on a line, and lace 8 holes. All these items had to be completed in an allotted period, and the tasks involved items that are concrete, and which can be manipulated. Lilly was also unable to complete visual-motor tasks on a symbolic level, as her drawing and copying functions were found to be poorly developed and lower than children of her own age.

Successive processing is conceptualized as the organization of information in a linear way (Naglieri et al., 2012). The deficits in Lilly's successive processing were reported in comments from both her parents and teacher. These behaviors included an inability to memorize things that come in order, poor understanding of time, and forgetfulness, and were observable both at home and at school. Constructs such as the repetition of numbers both backwards and forwards were also not attained, nor were sequencing activities on the gross motor subscale, which indicated difficulties for Lilly in this area.

Planning involves higher-order cognitive processing based on the information that has been coded (Das et al., 1994). A plan of action must then be generated and, before it can be carried out, modulated to maximize the possibility of attaining its aims (Naglieri et al., 2012). Deficits in planning involve executive functions responsible for controlling and organizing behavior as well as monitoring performance. Executive functions are judged in relation to higher-order cognitive functions, which include amongst others self-awareness, emotional self-regulation, inhibition, verbal and non-verbal working memory, self-motivation, planning and problem-solving (Cristofori et al., 2019). It was found that Lilly struggles to complete tasks and is unable to change her strategy when her execution is incorrect (e.g., if a form does not fit into a formboard, she will not seek other ways of executing the task). Lilly's lack of impulse control also did not allow for a steady monitoring of her executive processes and behaviors.

Feedback is important after an action has ensued, so that a modified plan may be applied to a similar problem in the future. Her lack of self-regulation means that Lilly cannot strategize to obtain the correct result due to general chaotic functioning. As such, the model used was able to clarify that deficits in one unit impact the other processing units.

Based on the findings presented, it is possible to assert that the use of the Griffiths III as a developmental measure played an important role in the presented study by highlighting the challenges and strengths in the different developmental domains. In this way, the model provided additional information about Lilly's

development, which could be used to make informed decisions about the way forward when planning her interventions. ADHD is a complex disorder that requires assistance from a multidisciplinary team. Accordingly, Lilly was found to have developmental challenges across all learning domains, which means she requires assistance from pediatricians, occupational therapists, remedial teachers, and speech therapists in conjunction with her parents (i.e., home-based interventions) and classroom teacher. These findings, thus, indicate that no one individual healthcare professional is or should be responsible for all of Lilly's interventions.

7. Conclusion

The assessment presented in this study used Griffiths III, which supported the diagnosis of ADHD-C as suggested by the Conners 3 questionnaires. Tseng et al. (2004) further described the greater difficulty with gross motor skills, as presented in ADHD-C. In the given case study, the referral question was related to what extent medication might assist Lilly to function more effectively in the classroom, considering that stimulant therapy has been proven to focus both on improving attention and executive functions in children with and without ADHD. This question was posed as Lilly's parents are reluctant to place her on stimulants at 5 years of age. This reservation stems primarily from their concerns about the possible long-term side effects of the medication.

The referral question regarding medication might, however, be renegotiated using the results obtained on the measure presented in this study. However, Lilly's teacher is concerned that the child is not benefiting from learning strategies, as there are too many barriers for her to negotiate alone. Therefore, the teacher strongly believes that stimulant medication could boost Lilly's dopamine levels and thereby enhance her focus and concentration. The other domains assessed indicated that Lilly faces challenges across all five developmental domains.

This research consisted of a single case study; thus, generalization of the findings is not possible. Multiple case studies could, therefore, potentially provide a better understanding of the usefulness of the Griffiths III when assessing atypical children. However, it can still be concluded that the Griffiths III, together with other healthcare assessments, is an appropriate tool to assist with the assessment of children with neurodevelopmental disorders as it can inform both parents and educators in a manner that might better guide them in respect to how to effectively use diagnostic results and design effective intervention.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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