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REVIEW ARTICLE

Differentiated Instruction as a School-based Educational Intervention: Integrating the CCAS and CHC Frameworks to Support Inclusive Education in Singapore

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ABSTRACT

This conceptual-practice article aims to discuss the value of differentiated instruction (DI) as a means to provide educational intervention to students with learning difficulties, in light of the current trends in education reforms in Singapore towards inclusive education. First, an overview of how inclusive education has evolved in Singapore will be provided. Next, an intervention model in the form of a literacy intervention programme (LIP) carried out in a Singapore mainstream primary school for a group of Primary 2 students with learning difficulties will be presented. This DI-driven programme, when integrated with Cognitive-Conation-Affect-Sensory (CCAS) framework and the Cattell-Horn-Carroll (CHC) theory of cognitive abilities, is designed to provide students with special learning needs a more meaningful access to the mainstream curriculum, as well as a more holistic and nurturing learning experience. Finally, the barriers impeding mainstream inclusion in Singapore will be briefly discussed, in the hope that future efforts may be directed towards the elimination of these barriers to promote meaningful inclusive education.

Keywords: *cattell-horn-carroll, inclusive education, differentiated instruction, special education, educational intervention*

1. INTRODUCTION

Since the development of the Salamanca Statement on Principles, Policy and Practice in Special Needs Education and a Framework for Action in 1994 [1], countries around the world are increasingly embracing inclusive education as an official policy and practice [2]. Table 1 below provides an overview

of how inclusive education has been enacted in Singapore since 1988, when the Ministry of Education, Singapore (MOE) became involved in the funding and management of special education schools [3-6].

Table 1. Key Milestones of Inclusive Education in Singapore [3-9]

Time	Key initiatives or policies
Pre-1988	Prior to 1988, special education in Singapore was provided by seven voluntary welfare organizations (VWOs) in 11 special schools. Special education was fully funded by the Singapore Council of Social Service (later renamed National Council of Social Service or NCSS).
1988	In 1988, the Advisory Council for the Disabled was established by the then Singapore Minister for Education, Dr Tony Tan, and one of the major milestones achieved by this council was that the MOE became an equal partner with the NCSS in the funding and management of special education.
2003	Compulsory Education Act 2000 came into effect. All children born after Jan 1, 1996, except those with special needs, must attend a national primary school. Early Intervention Programme for Infants and Children (EIPIC) launched for children aged six and below who require medium to high levels of early intervention support.
2005	Special Needs Officers (SNOs) deployed to mainstream schools, with training for teachers (Certificate in Special Needs Support) starting, moving towards mainstreaming students with mild or moderate needs [5].
2006	Ministry of Community Development, Youth and Sports (MCYS) and NCSS embark on creating inaugural Enabling Masterplan for 2007 to 2011.
2012	Development Support and Learning Support Programme rolled out for children who need low levels of early intervention support in pre-schools.
2013	On 18 July 2013, Singapore ratified the United Nations (UN) Convention on the Rights of Persons with Disabilities (CRPD), committing to more inclusive educational practices.
2019	Amendments to the Compulsory Education Act brought children with moderate-to-severe special needs into the national system, recognizing Government-funded SPED schools as primary schools. Launch of EIPIC Under-2s programme and Development Support-Plus programme.
2022	Seven autism spectrum disorder-specific special education schools to begin operations in phases till 2027.
Ongoing	Focus shifted to collaborative models (e.g., Inclusion Coordinators, Inclusive Support Programme) within the general education framework, emphasizing early support, teacher training, and parent involvement, reflecting the national goal of an inclusive society.

Figure 1 encapsulates how inclusive education in Singapore has gone through core philosophical shifts in the past few decades, from the initial charity-based model marked by segregation, to a participatory model where key government agencies are involved in running a dual system of education (mainstream education and special education system), and more recently, a collaborative model with the MOE being the key driver for mainstream inclusion. The latest model for inclusive education in Singapore goes beyond the provision of infrastructure and funding and moves towards strategic reforms such as the amendment of the Compulsory Education Act [7] in 2019, and the Enabling Masterplan 2030 [8]. This mainstream inclusion model aims to ensure that students with special learning needs are given fair opportunity to participate in activities and educational experiences with their neurotypical peers in mainstream schools. However, they also attend some classes separately during certain curricular hours [9].

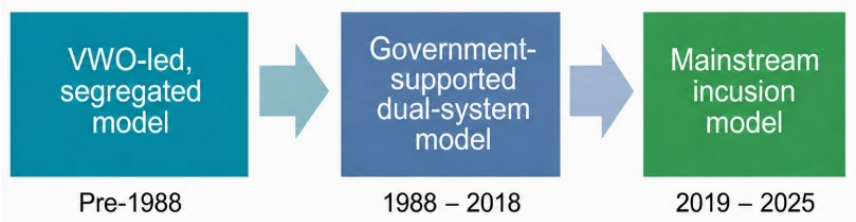


Figure 1. *Paradigm Shifts in Inclusive Education in Singapore [7-9]*

While inclusive education is relatively new in the Singapore education landscape, the philosophy underpinning the current mainstream inclusion model has in fact been expounded in the very first Report of the Advisory Council for the Disabled: Opportunities for the Disabled [10], which stated that "whenever appropriate and feasible, special education should be provided within the regular education system. A child should only be placed in a special school if he cannot be well educated in a regular school" [3]. Hence, the present modus operandi to integrate students with mild to moderate special

education needs or learning disabilities into the mainstream schools whenever possible is aligned with the early recommendation way back in 1988; segregated special education should only be provided for a small group of students who are unable to thrive in the mainstream settings, and requires an individualised educational plan.

2. Inclusive Education: The Singapore Education Landscape Today

Following the amendment of the Compulsory Education Act [7] in 2019, the contemporary classrooms in mainstream schools are becoming increasingly diverse due to an exponential rise in the enrolment of students with special needs [11].

As of 2023, there are about 36 000 students with special educational needs in Singapore, with 80% in mainstream schools and 20% in SPED schools, between the ages of 7 and 18 years old [12]. It is also worth noting that this group of 36 000 students is only the tip of the iceberg, if we were to consider another group of students. This group consists of students who present traits of learning disorders but are undiagnosed for various reasons, as well as those who are stuck in a long queue awaiting assessment. These students, if taken into consideration as well, would constitute a significant number, and should not be excluded in terms of policy formulations and resource allocation.

Before we delve deeper into inclusive education in Singapore, it is important to first establish a common understanding of what inclusive education entails, or what it is envisioned to entail, in Singapore. In research carried out by the Disabled Persons Association, Singapore (DPAS) [6], the ambiguity about inclusive education has been identified as a systemic barrier in its implementation. It highlights the potential contesting views that policymakers, service providers, families, caregivers and even persons with disabilities may have on what “inclusive education” should look like [6]. While some see it as providing placement in a mainstream classroom, others may mistake it as providing a one-size-fits-all curriculum to the entire cohort of neurodiverse learners in the name of fairness and equality.

According to Ms. Michelle-Lynn Yap, Course Chair, National Institute of Early Childhood Development – Ngee Ann Polytechnic (NIEC/NP), “valuing diversity goes beyond simply opening classroom doors and accepting all children. To ensure children with diverse needs have effective access to learning, a total environment is required” [13]. Ms. Yap also emphasised that being inclusive does not mean that all children are supported equally. Children must be placed where their needs can be best met, with equity emphasised over equality. This interpretation of inclusive education is congruent to the philosophy underpinning the latest mainstream inclusion model in Singapore, and will be the adopted stance in this article.

Therefore, inclusive education is not just merely placing learners of diverse needs together in the same physical space, but involves an organisation-wide shift in mindset, intentional planning, equitable (not equal) allocation of education resources, learner-centric pedagogical practices, and collaboration with all the stakeholders in education, in order to create a nurturing and empowering space for all students to grow and learn [13].

3. DIFFERENTIATED INSTRUCTION: A NECESSARY STEP TOWARDS INCLUSIVE EDUCATION

Since the goal of inclusive education in the mainstream school system is to provide meaningful access to a school curriculum that effectively responds to the diverse needs of students, a paradigm that is gaining ground in many educational circles is differentiated instruction [14], as it provides a holistic framework in which diversity among students in terms of readiness, interests and learning profiles can be accommodated [15].

3.1 Key Characteristics of Differentiated Instruction

The five key characteristics of differentiated instruction identified by Tomlinson [16] illustrate the efficacy of DI as a robust mechanism for driving inclusive education in Singapore:

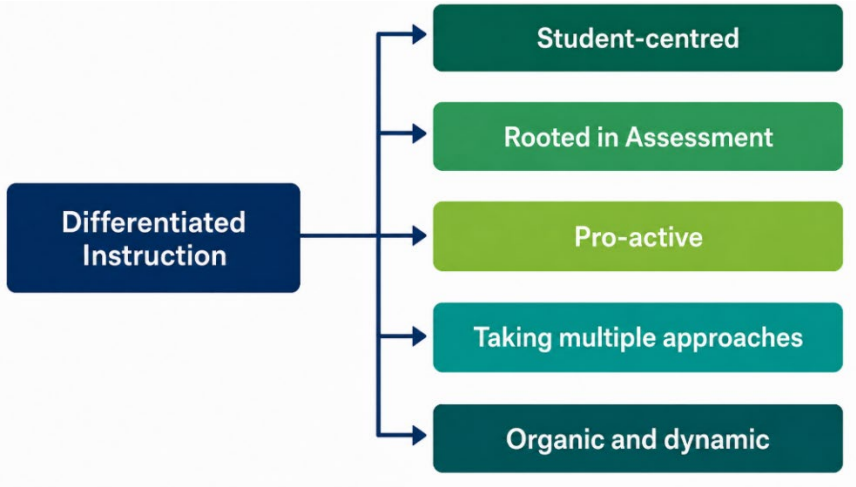


***Figure 2**. Five Key Characteristics of Differentiated Instruction*

In a differentiated classroom, the teacher is attuned to, and attends to, the variance among students in terms of readiness, interests and learner profiles [16]. The teacher would continually ask, "What does this student need at this moment in order to be able to progress with this key content, and what do I need to do to make that happen?" [17] instead of "What does the curriculum scheme of work require me to cover and how many periods am I given to deliver the key content to all my students?"

The teacher would also gain insights of what works for each student through formal and informal assessments, class observations, student work, conversations with the students, or discussions with others who work with the students. Based on these insights and assessment data, the teacher proactively plans lessons and makes reactive adjustments whenever the intended learning is not taking place for some. Adjustments to the lessons can take place through differentiating the curricular components of content, process and product, so as to offer different approaches to what students learn, how they learn, and how they demonstrate what they have learnt.

In such a classroom, teaching becomes organic and dynamic, as the teacher continuously observes and reflects on how the students learn, monitors the match between the learner and the learning activities conducted and makes adjustments to bring about the best fit. The classroom becomes a learning environment where neurodiverse students will not be seen as misfits who need to be segregated. Rather, learner diversity is "normal and desirable" and teachers should plan, teach and reflect with those differences in mind [17].

3.2 Differentiated Instruction in the Singapore Context

Although Singapore has yet to officially embrace inclusive education as a national policy, its education system espouses the student-centric ethos of teachers engaging learners by responding to individual differences in interests, strengths and learning needs [11]. Similarly, the practice of differentiation is believed to be "rooted in a student-centred philosophy or ethic of teaching" and is the manifestation of a conviction that every student is both unique and of prime importance as a learner and as a human being [17].

While class size has been commonly cited as a key barrier to implementing differentiated instruction in mainstream classrooms [15], to say that teachers simply do not have the time to attend to student differences is akin to a doctor telling a patient that there are too many patients for individual symptoms to be considered [16]. The learning experiences in the classroom can only be effective if the teacher acknowledges that the knowledge and skills that he or she is trying to teach must be built on the students' previous knowledge and skills. Not all students possess the same learning foundations at the onset [16].

The necessity to address learner diversity in order to bring about effective teaching and learning is best presented by Tomlinson's "*Line of Logic for Differentiating Instruction*" [16]. As shown in Figure 3 [16] below, differentiated instruction is not an option or occasional act by teachers, but a necessary step towards inclusive education.



Figure 3. *The Line of Logic for Differentiating Instruction*

3.3 Curriculum Modifications in Differentiated Instruction

Having established the grounds for differentiating instruction as a necessary move towards promoting inclusivity, this part of the article will look into how differentiated instruction can be unpacked at the classroom level. According to Tomlinson & Imbeau [17], differentiated instruction involves the modification of four curriculum-related elements, namely the content, process, product and affect.

3.3.1 Content Modification

Content refers to the knowledge, understanding, and skills that we want students to learn [17]. Modification of the curricular content does not equate to content reduction and retaining only the 'low-level' tasks that require only regurgitation of facts and little comprehension. It may include coming up with an alternative or supplementary curricular content needed by some students in order to move ahead in the mainstream curriculum [17]. For example, a Primary 2 student who is unable to read sight words at the pre-primer level would need a sight word-based curriculum first before he or she can access the Primary 2 mainstream English curriculum. Sometimes, non-conventional content such as the teaching of executive functions or training of cognitive specific abilities, if included, would contribute greatly to the student's learning as well.

3.3.2 Process Modification

Process refers to activities that enable students to make sense of the content [17]. Within a typical mainstream class, all the students would have the same chronological age. Despite so, the teacher should bear in mind that chronological age is a very crude index of each student's developmental abilities and interests [17]. This is especially true for students with special learning needs, and hence, modification to the processes in which they interact with the content must be made with that in mind.

3.3.3 Product Modification

Product refers to how students demonstrate what they have come to know, understand, and are able to do after an extended period of learning [17]. Modification of the curriculum product should shift away from high stakes summative assessments that are predominantly pen-and-paper tests. Continuous, authentic and developmentally appropriate assessment should be included as well, together with

informal observations, to provide the teacher insights of the students' learning progress and input for the planning of upcoming lessons.

3.3.4 Affect Modification

Affect refers to how students' emotions and feelings impact their learning [17]. Since respecting individual differences and student-centricity lies at the heart of differentiated instruction, modifications must be made such that the teacher teaches for success and promotes growth in every student. Modifying the learning environment would also have a positive impact on their affect and promote learning. Tomlinson and Imbeau [17] describe the learning environment as the physical and emotional context in which learning occurs. Firstly, the appearance, organisation and structure of the classroom should support individual seatwork and collaborative work. Choice of furniture and their arrangement would focus on facilitating teacher-student, as well as student-student interactions. On top of the physical environment, the intangible emotional climate is vital to make every student feel safe, respected, involved, challenged and supported.

Figure 4 [17] shows how the four curricular elements above are related. The Mobius-like triangle represents the interdependence among content, process and product, and rather than static entities that are addressed in a sequential order, they are continually influenced by how each element has evolved as the learner changes and grows. The learner is posited in the centre of the triangle to signify that the content, process and product modifications would be centred on the learner's profile. The interplay of these elements would take place within a learning environment that is shaped by the physical layout and emotional climate in class, teacher's beliefs and actions, as well as the support at the infrastructural, legislative and policy levels.

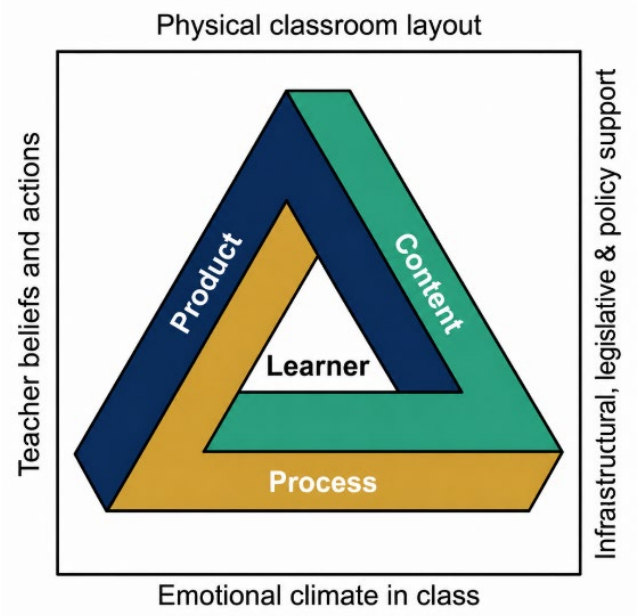


***Figure 4**. Dynamic Interplay of Key Elements in DI-driven Learning Environment [17]*

4. DIFFERENTIATED INSTRUCTION AS A FORM OF EDUCATIONAL INTERVENTION

In the earlier sections, it has been mentioned that within the mainstream education system, the number of students with special educational needs, learning disabilities, as well as specific learning difficulties, is on the rise and they account for a significant percentage of the mainstream cohort. In order for these students to have meaningful access to the mainstream curriculum, their differences in areas such as family background, culture, language, interests, readiness to learn, modes of learning, speed of

processing information and self-awareness, need to be addressed, as these differences would profoundly impact how they learn and the nature of support they require during the learning process [17]. It is on this premise that differentiated instruction, in the form of educational intervention, is proposed as an effective vehicle to drive mainstream inclusion for this group of students.

4.1 Literacy Intervention Programme (LIP): A School-based Initiative for Educational Intervention

Currently, each primary school in Singapore has two Special Educational Needs (SEN) officers to provide learning and behavioural support for students with higher needs [18]. However, there is a lack of clear coordination or national policy about inclusion from which mainstream schools can develop their inclusive programmes and practice [6].

This part of the article describes a LIP that is implemented in a Singapore mainstream primary school for a group of Primary 2 students with learning difficulties. Unlike the existing support programmes initiated top-down by the MOE, such as the Learning Support Programme (LSP), Learning Support for Mathematics (LSM) and School-based Dyslexia Remediation (SDR) programme, this LIP is a school-based educational intervention designed and implemented by the author (an English Language teacher) for a group of students with reading and writing difficulties [18]. Instead of being highly prescriptive in terms of scope, content and assessment procedures, the LIP curriculum is emergent in nature and changes flexibly and timely according to the students' needs.

The LIP is a response to the feedback from the Primary One English Language teachers, raising their concerns over a group of students, who, after one year of tier-one intervention in class, are still unable to read common sight words, and struggle even to copy down answers for their daily work. It was felt that unless more targeted help is provided for these students, they are unlikely to progress and would remain non-participatory in class for the next academic year. The implementation process begins with teacher referrals using an author-developed referral form (Appendix A). This is followed by screening and shortlisting, and subsequently communication with parents. The procedural framework is detailed in Appendix B, developed through the author's consultations with school leadership.

4.2 Integration of the CCAS Model into the Literacy Intervention Programme

In this section, the cognition-conation-affect-sensation (CCAS) framework will be used to examine the LIP [19]. The CCAS model focuses on the human potential and apart from covering the three behavioural components of cognition, conation and affect, it includes the sensation component that links all the other three components together [19]. Cognition refers to the process of coming to know and understand; of encoding, perceiving, storing, processing, and retrieving information [20]. Affect refers to the emotional interpretation of perceptions, information, or knowledge. It is generally associated with one's attachment (positive or negative) to people, objects or ideas [20]. Conation refers to the connection of knowledge and affect to behaviour and is associated with the issue of "why." It is the striving component of motivation [20].

By integrating cognition, conation, affect and sensation into the LIP, the interventions would be able to address a wider spectrum of the students' needs. This is especially important as the LIP is not intended to be a remedial programme conducted to improve the students' assessment scores in the English standardised assessment tasks. It aims to not just address their learning needs in mastering the English subject, but to also strengthen the cognitive abilities needed to help them learn more effectively, build up their self-efficacy and confidence level, as well as to inculcate a growth mindset in them. It is an educational intervention that would support the holistic growth of the students. Table 2 describes each of the domains in the CCAS framework and examines how each domain is being addressed in the LIP [19].

Table 2. Using the CCAS framework in the LIP [19,20]

Domain: Cognition	
Description	Refers to the mental processes such as thinking, problem-solving and understanding.
Application to LIP	Developing tailored instructional materials and instructional strategies based on the student's cognitive strengths and weaknesses
Examples	• Use of visual aids to learn vocabulary • Replacing blank spaces with lined writing space to improve penmanship • Besides the prescribed English curriculum from MOE, a sight word-based curriculum is included. • Use of cognitive exercises to strengthen working memory • Fostering organisation skills, independence, and time management skills
Domain: Conation	
Description	Encompasses the will, motivation, and drive behind a student's actions and learning
Application to LIP	Developing intrinsically motivated and resilient students by fostering self-regulation, goal-setting and perseverance in the intervention processes
Examples	• For penmanship practice, students set their own goals on the number of pages they can complete with one period of lesson and check if their goals are met at the end of the lesson. • Varied teaching activities to motivate the students and inculcate joy in learning: - Making a 3D diorama to represent life cycle of a butterfly, observing life specimens of the butterfly when working on the book 'A Butterfly is Born'. - Making dough and learning the targeted vocabulary like kneading, patting, pounding and tossing through hands-on activities. - Magnets exploratory station when working on the book 'Magnetic Max' • Link what they learn from books to real-life contexts to create meaning in learning, thereby fostering intrinsic motivation to learn: - Extracting blue dye from blue pea flowers when working on the book 'A Day in the Kitchen with Grandma'
Domain: Affect	
Description	Involves emotions and feelings, which can impact learning and behaviour significantly
Application to LIP	Creating a supportive learning environment to help students to manage stress, alleviate anxiety, build friendship and feel joy in learning
Examples	• Positive reinforcement in managing behaviour • Acknowledge efforts despite failures or mistakes • Growth mindset posters in class to teach students how they can reframe their thinking • Model calm disposition, patience and optimism when managing negative emotions or behaviour • Praise generously for positive behaviour • Send messages to parents to share something positive about their child and remind them to give their child a hug or compliment • Use of humour during interactions • Wide selection of readers for students to exercise autonomy in choosing what they want to read, how many to read and where to sit
Domain: Sensation	
Description	Refers to the sensory processes and how students perceive and interact with their environment.
Application to LIP	Adjusting the classroom setup to minimise distractions and enhance focus
Examples	• Area with gym balls where students can bounce on and energize • Textured grass flooring that students can lie and roll on • Provision of different types of reading chairs • Movable charts and furniture that can be rearranged easily for group work or individual work • Wiggle seats provided for students who tend to slouch or fidget • Curtains to block out glaring sunlight

4.3 Integration of the CHC Theory of Cognitive Abilities into the Literacy Intervention Programme

With the CCAS model providing a broad holistic framework for the LIP, this section of the article moves on to explore how the Cattell-Horn-Carroll (CHC) theory of abilities can be applied to understand and design support for the LIP students at the activity level. The CHC model is based on psychometric intelligence and cognitive ability research conducted over much of the last century and is the most

strongly supported, empirically derived taxonomy of cognitive abilities [21]. It includes the broad constructs like visuospatial ability (Gv), working memory (Gsm), long-term memory encoding and retrieval (Glr), acquired knowledge or crystallised ability (Gc), processing speed (Gs), and fluid reasoning (Gf) [21]. There is also an additional level of more specific constructs known as narrow abilities.

Although the CHC theory is widely used in cognitive assessment, it can also be used in a school-based intervention like the LIP, as it focuses on targeting specific cognitive abilities linked to the learning challenges faced by the students. It enables the interventions to move beyond looking at surface-level academic challenges to focus on the specific cognitive processes underlying the student's learning challenges [22].

In the absence of a diagnosis, which is the case for all the LIP students, the list of broad and narrow abilities in the CHC model becomes especially useful in providing insights on the specific weaknesses that shape how reading and writing difficulties emerge. Table 3 [21,22] shows examples of how the CHC framework can be used in setting intervention goals and integrating them with the learning activities
planned for the LIP students. Even in the absence of assessment results or diagnosis, the development or strengthening of these literacy-related abilities would still be beneficial for the students.

Table 3. Using the CHC Theory of Cognitive Abilities in the LIP [21,22]

Broad Ability: Fluid Reasoning (Gf)		
Intervention Goals for Narrow Abilities of Gf		**Strategies / Learning Activities**
Gf-I.1	Induction: To discover the underlying characteristic	In a grammar lesson on singular and plural nouns, show students plural nouns that are formed by adding '-s', '-es' and '-ies' and get them to sort out and discover the underlying rule for forming plural nouns.
Gf-I.2	Induction: To apply a previously learned rule to a given problem	Students make use of a grammar rule learnt in the context of new sentences (e.g. applying the rule for subject-verb agreement, conditions for use of articles 'a', 'an', 'the')
Gf-RP.1(i)	Piagetian Reasoning (Seriation): To organise material into an orderly series that facilitates understanding of relations between events	Given a set of 4 pictures, students are to organise them into a logical sequence and tell a story based on their sequence.
Gf-RP.1(iii)	Piagetian Reasoning (Classification): To organise materials that possess similar characteristics into categories	In a grammar lesson on nouns, students can classify nouns into names of people, places or things. Another example would be to classify sentences that indicate past / present or future events in a grammar lesson about tenses.
Broad Ability: Comprehension Knowledge (Gc)		
Intervention Goals for Narrow Abilities of Gc		**Strategies / Support provided**
Gc-LD.1	Language Development: To develop an understanding of (i) words, (ii) sentences, and (iii) paragraphs	At word level: Playing 'I-Spy' naming games, word search activities based on given descriptive phrases, and use of visual aids to build associations. At sentence level: 'Draw-and-write' activity where students follow a series of sequential steps to draw a picture and based on the features and environment they have added, to write sentences to describe their drawing. At paragraph level: Sequencing a set of related sentences into a logical paragraph, and then building the paragraphs to form a narrative.
Gc-VL.1	Lexical Knowledge: To understand an extent of vocabulary – (i) nouns, (ii) verbs, or (iii) adjectives – in terms of correct word (semantic) meanings.	• Use of 'alphaboxes' to write down new words learnt. • Provision of picture-based word cards to classify nouns, verbs and adjectives in a grammar lesson. • Conversion of picture cards used in lessons into e-flipbooks and posted to parents and online learning platform as reinforcement.

Gc-LS.2	Listening Ability: To (i) receive and (ii) understand spoken information. (Classification): To organise materials that possess similar characteristics into categories	• Students to listen to a short text and sequence a set of pictures depicting the text in chronological order. • Students to listen to a short text and answer questions based on the text information. • Students to listen to a sentence being read out and choose from a set of 4 pictures, the one that depicts the sentence most accurately.
Gc-CM	Communication Ability: To speak in "real life" situations (e.g., conversation, lecture, group participation) in a manner that transmits (a) ideas, (b) thoughts, or (c) feelings to one or more individuals.	Picture Stimulus Conversation-Students to look at a photo and speak about what they think is happening, why it happened and share what he would do or feel if he is in the same scenario.
Gc-MY.1(ii)	Grammatical Sensitivity: To allow for the formation of sentences (syntax).	Students given sets of word cards and they are to arrange the word cards to make grammatically correct sentences.
Broad Ability: Auditory Processing (Ga)		
Intervention Goals for Narrow Abilities of Ga		**Academic area & Strategies / Support provided**
Ga-US.2	Speech Sound Discrimination: To discriminate differences in phonemes or speech sounds under conditions of (a) little or (b) no (1) distraction or (2) distortion.	• Phoneme isolation: Students to listen to a word and identify the beginning, middle or ending sound. • Listen to a short story and answer questions about it, focusing on key details. • Listening to multi-step instructions to build listening skills.
Broad Ability: Short-term Memory (Gsm)		
Intervention Goals for Narrow Abilities of Gsm		**Strategies / Support provided**
Gsm-MS.4	Memory Span: To reproduce the series of elements in correct order.	'Peek-A-Boo Spelling' – Students to look at each letter or chunks of letters being flashed on the screen for a brief period of time, and then asked to write down the spelling of the whole word formed by those letters immediately after they disappear.
Broad Ability: Long-term Storage and Retrieval (Glr)		
Intervention Goals for Narrow Abilities of Glr		**Strategies / Support provided**
Glr-NA	Naming Facility: To rapidly produce accepted names for concepts or things when presented with (a) the thing itself or (b) a picture of it (or cued in some other appropriate way).	Flash picture cards of past learnt vocabulary and get students to say out the corresponding naming words.
Glr-FW.1	Word Fluency: To rapidly produce isolated words that have specific (a) phonemic, (b) structural, or (c) orthographic characteristics (independent of word meanings).	Spin a spinner, identify the sound, and then find the picture with the same sound. (e.g. choosing the pictures showing 'cloud', 'clock' and 'classroom' when spinner points to 'cl'.
Broad Ability: Processing Speed (Gs)		
Intervention Goals for Narrow Abilities of Gs		**Strategies / Support provided**
Gs-RS.1	Reading Speed: To silently read connected text (e.g., a series of short sentences; a passage)	• Using a finger or pencil to guide the student's eyes, reinforcing focus and preventing regression when reading a text. The pace can be slowly increased over time. • Daily reading booklet, comprising of sentences or paragraphs extracted from the learning sheets used in the mainstream curriculum.
Gs-RS.2	Reading Speed: To comprehend connected text (e.g., a series of short sentences; a passage) (a) rapidly and (b) automatically (with little conscious attention to the mechanics of reading).	Chunking: Grouping phrases using different colours and getting students to focus on the key nouns or verbs rather than every word in order to process information faster.
Broad Ability: Psychomotor Speed (Gps)		
Intervention Goals for Narrow Abilities of Gps		**Strategies / Support provided**
Gs-WS.1	Writing Speed: To correctly copy (a) words or (b) sentences repeatedly.	Students to copy sight words and sight word-based sentences repeatedly as part of their penmanship practice.

Gs-WS.2	Writing Speed: To write (a) words, (b) sentences, or (c) paragraphs, as quickly as possible.	Students to write out sentences and paragraphs based on the class dictated story activity. Different levels of support are provided, depending on the needs of the individual student (e.g. triple-lines instead of single-line writing paper, dotted words to trace for progressive psychomotor training)
Broad Ability: Reading and Writing (Grw)		
Intervention Goals for Narrow Abilities of Grw		**Strategies / Support provided**
Grw-RD.1	Reading Decoding: To recognize (a) words or (b) pseudowords in reading.	• Use of books with controlled vocabulary to let kids practice decoding skills and build confidence. • Word walls in classroom as visual aids to foster sight word recognition.
Grw-RC.1	Reading Comprehension: To attain meaning (comprehend and understand) connected discourse during reading.	• Use of AI to create consistent character illustrations to enhance understanding of a given text or passage. • Front-loading vocabulary – Teach the meanings of words from a passage that are likely to be new to students before introducing the whole passage. By first teaching the unfamiliar words that might hamper their understanding of the whole passage, it reduces the chances of students getting confused or discouraged.
Grw-V.1	Verbal Language Comprehension: To develop (a) words, (b) sentences, and (c) paragraphs in target language.	• Engage students in rich conversations by asking open-ended questions. • Read together to build students' vocabulary and comprehension.
Grw-CZ.1	Cloze Ability: To (a) read and (b) supply missing words (that have been systematically deleted) from prose passages.	Contextual clues: Teach students to use surrounding words (forward and backward referencing) to infer the missing words' meanings and functions. Incorporate annotation skills to highlight the contextual clues.
Grw-SG.1	Spelling Ability: To form words with the correct letters in accepted order (spelling).	Letter building: Use of magnetic letters to build the words. Can incorporate 'word ladder' game where students replace one of the letters to form another new word.
Grw-WA.1	Writing Ability: To communicate (a) information and (b) ideas in written form so that others can understand with clarity of (i) thought, (ii) organization, and (iii) good sentence structure).	• After sequencing a set of pictures to form a story, students will construct sentences to relate the story. • Reorganising a set of jumbled-up sentences to form a viable paragraph depicting a given picture.
Grw-EU.1	To know the "mechanics", i.e., (a) capitalization, (b) punctuation, (c) usage, and (d) spelling, of written language.	• Fix-it! Activity where students role play as teachers and are tasked to correct sentences with capitalisation, punctuation and spelling errors. • Reinforcing on a daily basis as students write their names and date on their learning sheets (e.g. ensure that they use capitalisation for proper nouns such as their names and months).

4.4 Evaluation of the LIP

The LIP described above is a practice-based intervention model that has been implemented by the author as a ground-up initiative to improve inclusivity for a group of students with learning difficulties. It serves as an example of how a classroom practitioner can address the learning needs of students to some extent by modifying the curriculum, the teaching processes and integrating new curricula components, in spite of the gaps in the existing educational framework in mainstream school systems.

Although the LIP is not a formal research study with an explicit evaluation framework, higher student engagement, reduced absenteeism, positive feedback from parents, other subject teachers, as well as the SEN officers, are some modest indicators of success for the LIP. The reflection shared by the author with her school in Appendix C also sheds light on the curriculum modifications made and how the intervention programme has impacted both the teacher and the learners positively. Although the reflections shared are based on the personal experiences of the author and may not be generalised, the detailed description of the programme, including the DI-CCAS-CHC triangulation of frameworks, is still sufficient for replication or adaptation by classroom practitioners or school leaders interested in

exploring holistic school-based educational intervention models for the neurodivergent learners in their schools.

5. BARRIERS TO MAINSTREAM INCLUSION

Despite the movement towards inclusive education and differentiated instruction being a promising form of educational intervention for students with learning difficulties in mainstream schools, there still exist barriers that could limit the success of mainstream inclusion.

First of all, there are several barriers within the Singapore mainstream classroom. In a qualitative study by Strogilos and team [15], there is resounding evidence that factors such as big class size, the need to deliver a prescribed curriculum that directly leads to a high stakes national examination, as well as the lack of effective resources to support students of diverse learning needs, are significant stumbling blocks towards the creation of an educational system where every student can meaningfully access the curriculum. A research study commissioned by the MOE to look educators' perspectives on inclusion also revealed that teachers in mainstream schools feel that there is insufficient training to prepare them for inclusion [23]. They also felt that big class size, high number of students with special educational needs, and lack of support from the allied educator (AED) make it hard to implement inclusive education. Self-efficacy of teachers and limited support from the school leadership and parents are also recurring issues brought up in similar studies [24,25].

Teachers are also found to hold restricted understandings of differentiated instruction, leading them to equate differentiated instruction with content or workload reduction for students perceived to have lower abilities [15]. The individual support that some students require is often addressed by assigning buddies to the students to help them with their work or to serve as prompters. Last but not least, while Singapore has advanced from the segregation model to a mainstream inclusion model in addressing inclusive education, teachers in the existing mainstream classrooms may still hold the perception that the needs of students with special needs or specific learning difficulties are best met by psychologists, therapists or the Special Needs officers. This division of labour is rooted in the segregation model. Hence, while Singapore is trying to keep up legislatively, meaningful change can only be exacted when there is a shift in mindset of all the stakeholders in education.

6. CONCLUSION

Inclusive education is definitely on the agenda of policy makers in Singapore, and given the rising number of neurodiverse students in the mainstream schools, as well as the long wait time in the special education (SPED) schools [26,27], the move towards more inclusive teaching practices such as differentiated instruction is pertinent. Differentiated instruction in the Singapore mainstream classroom should go beyond curriculum modifications in terms of content reduction and lowered expectations. Barriers to inclusive education has led to students with special educational needs being granted placements in mainstream schools but provided with limited support to access the mainstream curriculum meaningfully.

The LIP described in this article is proposed as a form of educational intervention that transcends the contextual constraints in the mainstream classrooms. Although it works on a pull-out system, and seems to contradict the goal of inclusivity, the far wider extent of curriculum modifications at the content, process and product levels, framed within the CCAS model, has provided a more meaningful and holistic learning experience for this group of students. Furthermore, the use of the CHC list of abilities to set intervention goals enhances the effectiveness of the learning activities and strategies used in the LIP. Hence, this partial pull-out model addresses the emphasis on "responsible inclusion" rather than "full inclusion" [28]. The former offers a more balanced and feasible approach while the latter cannot be fulfilled meaningfully due to profound barriers.

The LIP serves as an initial prototype for educational intervention in the mainstream school setting, and it is hoped that more flexible and creative models for mainstream inclusion can be explored by policy makers and classroom practitioners. For initiatives like the LIP to be successful, future directions in driving inclusive education through differentiated instruction should also focus on teacher training, inter-professional collaboration, and the development of an explicit national inclusion framework shaped by research findings not just in the field of education, but also in development and cognitive psychology, education therapy and neuroscience. More professionals in the fields of education, psychology and therapy should also be developed in tandem to support the movement towards mainstream inclusion.

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8. COMPETING INTERESTS

The author has declared that no competing interests exist.

9. FINANCIAL DISCLOSURE

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10. ARTIFICIAL INTELLIGENCE DISCLOSURE

During the preparation of this work, the author used Open AI to draw the figures. After using this tool, the author reviewed and edited the content as needed and take full responsibility for the content of the publication.

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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APPENDIX A

Referral Form for P2 Literacy Intervention Programme

Name of student: _____ ( ) Class: P1 _____

Name of EL teacher: _____

No.	The student can:	Teachers' Feedback
1	Arrange the 26 letters of the alphabet in order.	
2.	Identify the 26 letters of the alphabet.	
3.	Write out the 26 uppercase letters of the alphabet.	
4.	Write out the 26 lowercase letters of the alphabet.	
5.	Associate the uppercase letters to their corresponding lowercase letters and vice versa.	
6.	Discriminate "tall", "small" and "fall" letters when writing.	
7.	Write words of appropriate size and spacing in between the letters.	
8.	Write sentences with appropriate spacing in between words.	
9.	Discriminate letters such as 'b' and 'd', 'n' and 'u', 'm' and 'w', 'p' and 'q'.	
10.	Write his / her own full name accurately using the right uppercase and lowercase letters.	
11.	Write neatly and legibly on given lines.	
12.	Complete writing on time or keep up with the general class writing pace when taking down notes or answers.	
13.	Write with appropriate strength (e.g., writing is too light or too dark).	
14.	Answer comprehension questions at the literal level (e.g. 'what', 'who' and 'where' questions).	
15.	Read a given text, especially the high frequency words.	
16.	Listen to and follow verbal instructions accurately when hearing is not impaired.	
17.	Stay focused during lessons for at least 30 minutes.	
18.	Manage impulsivity and delay gratification.	
19.	Write and spell words in the class spelling lists.	
20.	Express ideas or personal needs in complete sentences.	

21.	Complete learning task with minimal guidance.	
22.	Copy what he/she sees on the whiteboard / screen accurately or tends to skip lines/ words when reading or copying (visual tracking).	
23.	Read and spell number words from 1 to 20.	
24.	Read at least 50% of the words on the Dolch List of Sight Words (pre-primer, primer, first grade and second grade list).	

Other information about the student: (e.g., Special needs, specific learning disability, receiving LSP)

(A) Other support programmes that student is enrolled in:

Name of programme:	Yes / No:
LSM	
LSP	
Transit Programme	
Others (please specify):	

(B) Student Behaviour in Class:

The student:	Yes / No
Loses focus easily	
Makes noises / sounds during lessons	
Leaves his seat without permission	
Leaves the class in the midst of lessons	
Demonstrates disruptive behaviour (e.g., shouts, provokes peers, throws things)	
Has poor attendance without valid reasons (e.g., oversleeping, family issues)	
Has poor management of emotions, esp. anger	
Others (please specify):	

(C) Main concerns of teacher(s) & parents:

(D) Strategies or measures tried by teacher to help student & their effectiveness*:

*You may attach copies of student's works to support concerns raised

APPENDIX B

Procedure for implementing the Literacy Intervention Programme

Step 1: Consultation with school leaders to set the goals and align beliefs on what suits the needs of these students.

Step 2: Forms (see Appendix A) given to the Primary One English Language teachers to refer students in their respective classes for LIP screening.

Step 3: Based on the list of names submitted by the teachers, the LIP teacher will check with the Special Needs Officers, school counsellor and year-head for any additional information about the student, such as psychology assessment reports, hospital memos or diagnosis reports provided by parents.

Step 4: Individual screening conducted by the LIP teacher for each referred student. The screening involves a variety of tasks to assess the student's current level of competency in the key literacy components like alphabet fluency, sight word recognition, writing speed, reading comprehension, as well as pre-writing skills like sequencing of events and sentence construction. Cognitive tasks involving logical deduction and visual discrimination are also carried out with the student. During the screening process, behaviour such as sweeping perception, impulsivity, attention focus and motivation are also observed.

Step 5: Names of students who are suitable for LIP are finalised and shared with the teachers and key personnel of the school English department. Requests for budget allocation and timetabling accommodations are also put forward to the personnel in charge.

Step 6: Communicating screening findings to parents of the selected students and obtaining consent for their child to undergo literacy intervention.

Step 7: Based on the data and observations of each selected student during the screening process, the LIP teacher prepares the learning resources needed.

Step 8: The selected students will leave their classrooms and attend lessons in the LIP classroom during the English Language periods reflected on their class timetable. Support is provided through a pull-out system where the students receive educational intervention through a modified STELLAR curriculum from the MOE and an additional sight word-based curriculum.

APPENDIX C

Author's Reflections on the LIP

Excerpt 1 from author's reflections:

The first week started off with all the pupils being very receptive to having their lessons in the new LIP room. The non-threatening and text-rich environment seems to appeal to them and allay their apprehension of being taken out of the class, so there was no issue with transiting to a new class per se. The pupils seemed to be able to perform better when the tasks are more varied (cutting, pasting, drawing, unscrambling words etc.). One interesting observation was that the pupils were more motivated to recognize the sight words when I printed them out and pasted them into a word wall. Seeking a particular sight word on the word wall is more appealing and exciting to the pupils and they looked for it excitedly and attempted to read more words from the wall. This was vastly different compared to the time they were asked to read the same list of sight words off a list printed on plain white paper. For this group of pupils, motivation and task variation is the key to engage them in their learning, and this is important as they were frequently commenting that they do not like learning because learning is boring, and requested to watch YouTube and the TV (which was what they tend to spend their bulk of time doing).

The pupils also needed to be taught to start with a capital letter, and leave spacing in between words. The writing of words tends to be slow for most of the pupils except for Renee, and the pupils who are slow in writing tend to have the wrong writing strokes. Early literacy skills like writing the letters of the alphabet using the correct strokes, leaving spacing in between words, exerting the right amount of strength and gripping the pencil in the right way do influence a child's learning, but once these have been neglected in the preschool years, little attention is paid to them later on and the habits are hard to change by then.

Last but not least, I hope that we can make use of our observations about these P2 pupils, and tackle some of the learning issues highlighted at the P1 level. Sometimes, little things that we assign little importance to might turn out to be stumbling blocks for the kids in their learning process. Many little stumbling blocks along the way can slow down and widen the gap significantly for a child who is academically or cognitively weaker.

Excerpt 2 from author's reflections:

The pupils were generally motivated and their confidence levels rose when they realized that they could do work on their own. They had not been able to access the language curriculum that was pegged to their chronological age due to their inability to recognize most of the sight words. This has led them to feel helpless and lost in class, and most of the time, they were unable to pen anything down on their worksheets as they could neither read what was on the learning sheets, nor spell what they wanted to write after comprehending the instructions. Hence, these pupils have not experienced success in learning for a sustained period of time and their sense of self-efficacy are generally low. Hence, besides trying to help them achieve higher academic standards, it is of equal importance to pay attention to the affective domain of their learning process. Choosing learning tasks that are pegged to their developmental age rather than their chronological age helps not just to build a strong foundation (that has been missing) but also to give them a sense of competence, that would in turn raise their sense of self-efficacy. To me, the latter is of utmost importance, for it is the affective factors that ultimately determine whether a child would persevere or give up, and whether they would learn out of intrinsic motivation in future. Therefore, in the process of our interaction at this initial stage, when their foundation in literacy skills is not strong yet, I would like to focus on selecting the right stimulus to present to them,

and mediate their sense of competence. I believe that their pace of learning would naturally pick up once we set the foundation right, even though it may take some time.

There are times when I was anxious for them to catch up with their peers soon, but I need to constantly remind myself to view them as who they are, and focus on what they need, instead of where they are now, compared to their peers. I believe the catching up would be a natural success eventually if we keep on focusing on doing the right things or things that are necessary for each child, no matter how delayed it has been. If we were to insist on moving them through the standard curriculum based on their age, and choose to let go of the missing foundation because we cannot turn back the clock, would what we build with the child be stable in the end? Would a structure be strong and sustainable without a firm foundation? How far can we go without the structure collapsing? Hence, much as this group of pupils should not be learning basic sight words or writing sentences instead of paragraphs, we have to provide them the time and space to do all these, because that is the very foundation, they need to sustain their learning later on.

As teachers and parents, we need to focus on what our children really needs, and feel less anxious about their placement with respect to the peers. There is also nothing wrong when they are not in the middle of the normal distribution curve. We have been so used to norms and moving ahead in herds, that being different or taking a less trodden path seems almost wrong or inferior in our current society. Since education is a cornerstone in nation building, we should have the courage and discipline to stick to doing what is right for each and every child, if we hope to have a truly inclusive society in future. While some of our children are not blooming in the same garden as the rest, we must not overlook the fact that they are still blooming, and equally beautifully.

~*See a child differently, and see a different child*~ (Shanker, 2019)

Excerpt 3 from author's reflections:

Besides the focus on key literacy skills, I would also like to strengthen the cognitive functions of the pupils so that their learning process can be more effective. The pupils have been observed to be generally impulsive in their work and do not check back on their work. For example, during comprehension skills they tend to choose their answers very quickly without reference back to the text. After writing out their answers, they also do not have the habit to check if the words have been spelt correctly. They were more interested in being the "first to be done" than the one to get the most correct.

Based on the above observations about the pupils' dispositions, I decided to try out some activities to mediate their impulsivity. The activities chosen are not language laden so that they would not be impeded from performing the cognitive functions required due to language-related factors. The activities look like puzzles to the pupils and they were highly motivated to solve them. The objective of this group mediation process is not to get them to solve the puzzles per se, but to get them to curb their impulsivity while solving the puzzles and realise that when they slow down and adopt a more systematic approach, their chances of success become higher. Through the activities, I tried to get them to take time to check through their answers instead of shouting "Done!" as soon as possible. The pupils were very receptive and even when I was not standing beside them to remind them, some were observed to check their answers on their own. For example, Renee pointed to both her puzzle card and answer card to try to check that every colour on each card matched, and she curbed her habit of matching the last 2 cards simultaneously. This little change in her actions resulted in her solving all the puzzles correctly!

Sometimes, when a child rushes through his or her work and does not check on the answers, we might casually remark that this child "cannot be bothered to do his or her work" and has a poor attitude towards his or her studies. And when it concerns attitude and not intelligence, we classify it as a "behavioural" issue. Actually, evaluating why a child fails to learn may not be as simple as attributing it either to "low

intelligence" or "poor attitude / misbehaviour". Attributing failure to the former tends to lead us to conclude that not much can be done to help the child, if we view intelligence as a "fixed asset" that each child is born with. Attributing failure to the latter tends to lead us to conclude that there is nothing we can do unless the child shows better attitude, and that undesirable behaviour is more of a voluntary nature, and the child can easily choose not to behave like that in class. The solution therefore lies in the child and not in the teaching and learning processes.

Through my observations of the pupils, I think that some, if not most, of the so-called behavioural issues are not just a casual display of poor attitude on the child's part. They could be due to cognitive dysfunctions, which, once mediated and improved, would lead to better "behaviour". The mediation of these cognitive dysfunctions that are impeding their learning, and manifesting in the form of "poor attitude" has to be incorporated into each and every task that the teacher presents to the child, and the quality of interaction between the teacher and the child. The table below shows the two specific cognitive dysfunctions I have chosen to mediate this week, and the goal is to gradually move the child from the right column to the left.

EXPLORATION OF A LEARNING SITUATION	
Systematic	***Impulsive***
▪ Approach a task in a goal-oriented way ▪ Take time to gather and assess all the information needed to define a problem ▪ Think through a task in an ordered and systematic way ▪ Control speed and precision when solving a problem	▪ Rush into tasks too quickly in a haphazard and disorganised way without appropriate attention to what is required or without adopting a methodical approach ▪ Have poor investigational strategies and will not see the need to gather and integrate all the information necessary to think through a problem ▪ Lack self-control and have difficulty adjusting the speed, accuracy and precision needed for a particular task.
RECEPTIVE VERBAL TOOLS AND CONCEPTS	
Precise and accurate	***Impaired***
▪ Understand concepts and related words in order to interpret incoming information ▪ Use language as a tool to receive information ▪ Use language as a system for reasoning and communication in social interactions ▪ Listen to and interpret (process) the language, which requires a knowledge of vocabulary, word and sentence structure (grammar); meaning of (semantics); and social and cultural contexts (pragmatics)	▪ Listen to and interpret spoken language inaccurately even though his or her hearing is normal ▪ Misinterpret instructions and questions ▪ Have poor comprehension skills that will hamper the interpretation of incoming language

I hope to improve my practice in this intervention programme by focusing on the designing and selection of the learning tasks, as well as the quality and nature of my interaction with the pupils. I hope to pay closer attention to identifying the underlying cognitive dysfunctions that are impeding their learning, instead of assessing them only in the meeting of specific academic standards. I foresee a lot of challenges if I wish to incorporate mediation of cognitive dysfunctions into the teaching and learning process, but it is something that I feel would reap huge and sustainable benefits for the pupils if we succeed in it.

Excerpt 4 from author's reflections:

As for Hafiz, I will not be assessing him in the same way as the rest of the pupils due to his condition. It would cause too much anxiety to get him to read a whole Dolch List of sight words to me. Hence, I would try to assess him informally through daily work and hands-on activities based on sight words. Strange as it sounds, the way to help a child diagnosed with selective mutism is to remove our expectations of him to speak, instead of proactively trying different means to make him speak. The mutism stems from anxiety over people's expectations of the child to speak, so only after eliminating that source of anxiety will the child open up and speak up eventually. Hence, I hope to ease Hafiz's anxiety by letting him realise that he need not always express himself through speech. There are many ways he can express his understanding and ideas, and there is nothing wrong with that. As time passes, and the anxiety lessens, I believe the speech will slowly become another mode of communication he can accept. I am not familiar with this condition, so I will continue to read up and learn how to help Hafiz cope with his learning.

Excerpt 5 from author's reflections:

I will focus on Hafiz for this week's reflections.

(a) Interaction with teacher and peers:

- Hafiz has been willing to communicate with me, but he will only speak to me on his own if he needs something (e.g., tissue paper, drawing paper, colour pencils) It is a good start that he is willing to initiate a brief conversation.

- When asked about what he is drawing, Hafiz is also willing to respond.

- Hafiz is able to answer questions at the literal level after reading a short text.

- He talks more freely to his classmate, Danish. He is also receptive to having Rainie as his reading buddy. He would read after her and complete simple multiple-choice questions fairly independently.

(b) Attention span in class

- Hafiz is able to maintain his attention on a single task for at most 30 minutes, after which he tends to lose focus and starts asking for paper to draw on. At present, I have managed his request to draw in class during lesson by getting him to complete a specific learning task first before I give him the paper and colour pencils requested. He is receptive to this arrangement and completes the task quite readily.

- In a 2-3 period lesson, Hafiz would tell me that he is tired after one period. This is the time when he would request for a "drawing break". I would not deny the request but will negotiate with him on how long this break will be and what he can complete after the break. For example, he was supposed to complete a fill-in-the-blanks exercise, comprising of 8 sentences. After taking 30 minutes to complete 4 sentences, he told me he is tired and keeps rubbing his eyes, and lying on the desk. I allowed him to have a "drawing break" and he promised to complete the remaining 4 sentences after 10 minutes. When time was up and I reminded him to stop, he stopped willingly without protest and completed the remaining 4 sentences smoothly.

- For Hafiz, allowing "drawing breaks" within a lesson seems to be an approach that works to keep him present and on task in class, but there will be potential challenges in maintaining a balance and negotiating on the amount of work to be done.