



Dyslexic Children's Experience of Home-Based Learning During School Closures: 4 Case Studies

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Abstract

During the coronavirus pandemic, schools across the world shut down and education was transferred online, with the education of half a million students in Singapore continued through “Home-based Learning” (HBL), delivered through online platforms, including the Student Learning Space (SLS), accessible to all schools. A system was developed to ensure that economically deprived families who lacked equipment could borrow this from school, and those with no internet connection at home could return to school to engage in online learning. By contrast, specialized support for children with special needs was not necessarily designed to address these needs. The impact of this on the potential 20,000 dyslexic learners in Singapore forms an important research area for further investigation. The current study gathered empirical evidence through one-to-one interviews of 4 students (2 from primary schools and 2 from secondary schools). Taking an ecological approach, the study also analysed the context of school, family and beyond. Hence, the study examined the participants' lessons and assignments as well as interviewed their mothers in order to form a complementary picture to answer the research question on their experiences of learning during HBL. The interview data was transcribed verbatim and analysed together with the artefacts for emergent themes across the cases. Data analysis surfaced 3 themes: dyslexic-(un)friendly use of technology, feedback- focused pedagogy and social-emotional support. These findings will help guide professional development for teachers in mainstream classes who design e-learning experiences for inclusive classes with dyslexic students.

Keywords: Dyslexia, distance learning, online learning, school closure, inclusive classrooms.

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INTRODUCTION

The advent of the coronavirus (Covid-19) pandemic has brought about unprecedented disruption. Education was not spared. Schools were hastily closed to stem community spread and remain closed in many countries. It was estimated that 90% of the world's student population (UNESCO, 2020) was affected by these school closures.

In Singapore, the education of half a million students continued through "Home-based Learning" (HBL) (MOE, 2020, April 3). HBL is best characterised as distance e-learning, defined as the use of e-learning to support distance learners (de Freitas & Roberts, 2003).

Much of this HBL is delivered through a number of online platforms including the Student Learning Space (SLS), accessible to all schools (Ministry of Education, 2020). Teachers typically required students to type text or upload word documents to SLS which does not offer text-to-speech features. Families who lacked equipment could borrow devices from the school. In addition, students who had no internet connection at home could return to school to engage in online learning.

In contrast to such support for economically disadvantaged families, support for those with special educational needs (SEN) was less forthcoming. It was not clear if these distance e-learning methods bore in mind the SEN children's learning needs. Given that the duration of this HBL approach was at least a month long, it is thus important to investigate how HBL was experienced by SEN children such as dyslexic learners, who are the focus in this study.

Dyslexia is defined as a specific learning difficulty of language learning and cognition that primarily affects accurate and fluent word reading and spelling skills. There are also associated difficulties in phonological awareness, verbal memory and processing speed (British Dyslexia Association, 2010; The International Dyslexia Association, 2020). The Dyslexia Association of Singapore (DAS, 2020) estimates that there are currently about 20,000 dyslexic students in mainstream classes at primary and secondary schools. In Singapore, children aged seven to twelve attend primary schools before they sit for a national examination to qualify for secondary school (for thirteen to sixteen-year-old students).

This paper presents an investigation of how dyslexic learners experienced HBL seen through an ecological lens. Hence, data was gathered through one-to-one interviews with the student participants and their mothers. It also examined their online school experience, including interaction with teachers and peers, as well as the larger context beyond family and school.

LITERATURE REVIEW

This section begins with defining dyslexia and the challenges that dyslexic learners face. This is followed by a review of literature on the use of technology and distance e-learning, and how they may help or hinder such learners.

Difficulties Faced by Dyslexic Learners in School

DAS (2019) defines dyslexia as:

a type of specific learning difficulty identifiable as a developmental difficulty of language learning and cognition. It is a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling.

Once conceived as a phonological dysfunction, dyslexia is now understood as encompassing a whole host of issues: from slow visual processing and auditory processing in combination with attention, sequencing, and timing difficulties, left-right confusions, to poor short-term memory (Bosse, Tainturier, & Valdois, 2007; Varvara, Varuzza, Padovano, Sorrentino, Vicari & Menghini, 2014). It is now thought to be a result of temporal processing impairment, characterized by the brain being unable to process brief stimuli in rapid temporal succession (Habib, 2000). Baddeley and Logie's model of working memory (1999) identifies the phonological loop as a key component of working memory responsible for storing phonological and verbal content received through auditory stimuli. This explains the plausible relationship between dyslexia and other difficulties associated with cognitive processes requiring the utilisation of working memory. Examples of such difficulties are planning, organising, sequencing and selecting tasks, sustaining focus and self-monitoring. It suggests reasons why these learners have challenges regulating their attentional resources to enable greater automaticity in retrieving information and switching tasks. Other challenges include manipulating, integrating and adapting information in response to dynamic situations and environments (Herbert, Kearns, Hayes, Bazis & Cooper, 2018).

Their challenges in learning can also be further attributed to procedural learning difficulties explained by the neural-systems approach of the cerebellar functions involved in language-related skills (Fawcett and Nicolson, 2007). Since procedural learning is the picking up of skills and habits with little conscious effort, impaired functions in the language-based procedural learning system result in children with dyslexia having difficulties performing tasks requiring automatisation such as listening to the teacher and taking notes at the same time. This is further supported by the automatization deficit hypothesis (Nicolson & Fawcett, 1990), where the learning of skills by students with dyslexia is neither automatic nor fluent.

A likely outcome of these difficulties is often demonstrated in their low academic school performance. This in turn can lead to serious effects on their social and emotional development such as low confidence levels, a lack of motivation, feelings of helplessness and inadequacy and disruptive or attention-seeking behaviour (Thomson, 2010).

Although some learners may develop compensatory strategies along the way, others may continue to struggle in managing curricular demands or keeping pace with their peers.

Use of Technology to Mediate and Remediate Learning for Dyslexic Students

With these struggles, it behoves us to examine if dyslexic learners will benefit from the use of e-learning tools, especially when they involve reading and spelling tasks. Fortunately, there has been research on the use of technology as effective learning and teaching aids for students with dyslexia in areas such as reading, writing, memory and even mathematical learning. For example, computer games with interactive and fun features incorporating audio-visual phoneme discrimination tasks are said to have contributed to improvements in visual-processing and short-term memory (Chai & Chen, 2017).

Technological advancements, coupled with greater emphasis on inclusive education, also facilitated the development of assistive technologies. These new developments aimed to offer students with learning challenges opportunities to overcome the obstacles they usually encounter in traditional environments (Chai et al., 2017). Assistive technology, as defined by Lewis (1998), is one that allows individuals to compensate for their impairments, focus on what they are capable of and experience success by improving performance. It enables learners with dyslexia to complete their tasks independently and efficiently, thereby improving their chances for higher academic achievement. Some applications such as Text-to-Speech (TTS) and voice recognition or Speech-to-Text (STT) are also readily accessible on tablets and smartphones. Spellchecker allows users to check for spelling errors, and Grammarly ensures the text is free of grammatical errors.

These tools are used by many, not just individuals with dyslexia. They help remove stigma and enable them to participate in activities on more equal terms with their peers. They are also better engaged when they are less dependent on teachers for help (Paramanatham, 2018; Svensson, et al., 2019).

The Advantages and Disadvantages of Distance e-Learning

Earlier, HBL has been described as distance e-learning. Though the two terms "distance learning" and "e-learning" are sometimes used synonymously, there are differences. The former connotes that the learner and teacher are separated by space and maybe even

by time; while e-learning involves "the use of electronic media for a variety of learning purposes that range from add-on functions in conventional classrooms to full substitution for the face-to-face meetings by online encounters" (Guri-Rosenblit, 2005, p. 469).

In Singapore, e-learning has increasingly become part of the local educational experience (Koh & Lee, 2008). Defined as "learning and teaching online through network technologies", e-learning has indeed been acknowledged by many as a powerful, alternative platform to the traditional classroom with the potential to engage learners effectively and accelerate learning (Hratinski, 2008). While students can use it to facilitate learning at home, teachers can also keep track of students' progress (Paramanantham, 2018). Up till the Covid-19 pandemic, most local e-learning initiatives have been carried out in an asynchronous mode to complement in-person learning in school.

Asynchronous e-learning allows students to perform learning tasks without the need to be in a certain place at a certain time. Although educators may set a time duration for learners to complete certain tasks, asynchronous learning offers learners the flexibility to access and complete learning materials at their own time and pace, as long as they have access to the Internet. Some examples of asynchronous e-learning tools are online portals, emails, blogs, pre-recorded video lessons or webinars, as well as online forums and discussion boards.

The platform adopted by all schools in Singapore for such asynchronous e-learning initiative is the Student Learning Space (SLS). All primary, secondary and post-secondary students in Singapore have access to the online portal set up to encourage learners to be self-directed and customise learning according to their needs and interests. School leaders and educators provide students with an array of quality curriculum resources to supplement and enrich students' learning experiences beyond the classroom (MOE, 2020).

A more recent development with the advent of higher broadband speeds is synchronous communication technologies such as video-conferencing tools. Termed synchronous online learning, such a mode enables students to interact with classmates and teachers through text-, audio-, and/or video-based communication of two-way media (Martin, Ahlgrim-Delzell & Budhrani, 2017). Proponents have lauded its use in instruction because it offers a real-time environment similar to that in face-to-face communication (Blake, 2000). It motivates learners to participate in the interaction while benefiting from immediate ongoing feedback (Chen, Ko, Kinshuk, & Lin, 2005). A study involving 105 participants at a college that exclusively serves students with LD, ADHD and Autism found that they preferred synchronous to asynchronous online discussions (Dahlstrom-Hakki, Alstad, & Banerjee, 2020). The participants reported greater engagement and motivation.

However, opinion is divided whether distance e-learning will benefit dyslexics. One study of dyslexic students enrolled in distance learning with the Open University in the United Kingdom found that they were just as likely to complete as their course mates, though less likely to pass or get good grades (Richardson, 2015). Perhaps, these learners could have benefited further from the use of computers. Crivelli, Thomson and Andersson (2004) argue that computers can help dyslexic learners by creating “a patient, non-judgmental environment” (p. 304) with functionalities that can support dyslexics in reading (e.g. text-to-speech features) and writing (e.g., assistance in planning and editing). As such, the use of information technology can bolster their self-esteem. It can even make learning fun with the inclusion of multimedia and games.

On the other hand, Beacham and Alty (2006) argue that the use of mixed media in e-learning (text, diagrams, sounds) can pose even greater difficulties because the switching of media stresses the dyslexic’s short-term memory. Other online experiences that tax the short-term memory include new routines such as password to log in (Blankfield, Davey, & Sackville, 2002), the need to keep track of discussions or even navigating hypertext structure because it involves reverse sequencing (Rainger, 2003).

Other problems posed by e-content include visual readability (e.g. choice of font and contrast of text) that can potentially exacerbate difficulties in visual processing (McCarthy & Swierenga, 2010; Rainger, 2003). However, this can be overcome with the flexibility for dyslexics to manipulate the text to larger fonts and more generous character spacing that can help them read faster (Rello & Baeza-Yates, 2017). Allowing them to submit type-written work on computers will both take away the stigma of poor handwriting and offer help with bad spelling via the spell-check function (Mullen, 2016). Distance e-learning may also be a boon to dyslexics who are typically reflective learners who work most effectively in isolation or in a one-to-one setting (Alsobhi, Khan & Rahanu, 2015, 116).

In the same light, synchronous activities such as web conferencing can also disadvantage dyslexics. Their difficulties in reading quickly and responding accurately in typing mode could mean that they cannot keep up with text-based or collaborative synchronous activities (Habib, Berget, Sandnes, & Sanderson, 2012; Ingram, Hathorn, & Evans, 2000). Dyslexic university students involved in a study investigating text-based synchronous e-learning reported difficulties learning in that modality (Woodfine, Nunes & Wright, 2008). This finding is consistent with another study involving 48 secondary students (half with dyslexia and other half without). In particular, the dyslexic participants struggled with unorganized synchronous discussion (Pang & Jen, 2018). Even asynchronous discussion in a forum was a challenge when posts were in long and complex sentences. In both studies, dyslexic participants reported lowered self-esteem when they were unable to keep up and participate as actively as others.

The Gap in Literature

As shown in earlier section, the extant literature does not present an unambiguous picture of whether distance e-learning is beneficial to dyslexic learners. This lack of clarity is compounded by the lack of empirical studies in this area. A search on two databases (Academic Research Complete and ERIC) using keywords "dyslexia or dyslexic", "online or e-learning" and "synchronous" uncovered only six peer-reviewed studies, of which only one involved school going children. The majority of the studies in this area seems to involve older students in institutes of higher learning (Pang, Chen, Teh & Anding, 2015). Also, semi-structured interviews or questionnaires were generally used to gather data. None of them took the ecological approach of analysing the context of school, family and beyond.

Such an ecological paradigm is necessary to gain "an all-round understanding of the child within their life-context" (Poole, 2003, p. 177) by taking into consideration the various sources of influence from the home and school, (microsystem) to political and cultural context (macrosystem). Examples of such an approach, though not in a distance e-learning context, include investigations into children and parents' perspectives on living with dyslexia (Leitão et al., 2017), parental abuse (Hurford, 2015), teachers' experiences on teaching and supporting students with dyslexia (Olivier, 2017).

Significance of Current Study

This study aims to fill the gap to better inform teachers and policy makers of the effects of distance e-learning on some individuals from a vulnerable segment of learners. The case study approach adopted can provide in-depth investigations of their experience during extended periods of school closure. The discussion can help advance the larger conversation on how teaching and learning can be redesigned not just for dyslexics but for all.

METHOD

Research Question

The present study sought to answer the research question: What are the experiences of dyslexic children, of learning during Home-Based Learning (HBL)? The latter is a term used in the Singapore education system when physical schools were closed and lessons migrated to distance learning mode largely driven by online platforms.

Research Design

The study took an ecological perspective that viewed the dyslexic child within the familial and larger context, taking into account the other factors influencing the child's

development. However, for the purposes of this study, the factors were limited to considering the microsystems at home (support from family) and in school (pedagogy and support from teachers) as well as the macrosystem (e.g. educational policy) The research was designed as an instrumental case-study with each participant investigated in-depth to understand the child's unique experience while looking for commonalities with other cases (Stake, 2006).

Ethics Protocol

The study complied with the ethical protocols set by Nanyang Technological University and DAS where the study was sited. Once the participants and respective parents were identified, they were briefed over a phone call on the nature of the study and their involvement. This was followed by an email with a soft copy of the Study Information Sheet attached, to seek written consent. In the latter, details on research objectives and procedures were clearly mentioned and matters pertaining to consent, anonymity, confidentiality and the right to withdraw were explicitly addressed.

Participants

They were shortlisted from among students who attended DAS support class in English Language. For maximal variation in participant sample, they were drawn against a matrix of gender, age and reading levels (See Table 1). At DAS, students undergo a bi-annual curriculum-based assessments (CBA) in areas such as Oracy, Phonology, Listening Comprehension, Reading Fluency, Spelling, Writing and Reading Comprehension. Based on their CBA performance scores in Reading and Spelling, the participants chosen for the study were drawn from two categories: Beginning / Intermediate and Advanced.

Table 1 Summary of Participants' Key Characteristics

Case**	Level (Age)	Gender	Reading levels	Other support / comments
Lee	Pri (11)	Female	Beginning to Intermediate	Mum helps in Mathematics; Attends Science group tuition.
Arun	Pri (12)	Male	Advanced	Has own room at home; Attends Mathematics individual private tuition.
Ian	Sec (13)	Male	Beginning to Intermediate	Attends group tuition in English Language; Attends individual private tuition in Mathematics and Science (separately; since Primary 3)
Tia	Sec (16)	Female	Advanced	Dad helps in Mathematics. Has own laptop in own room while brothers share device in the living room.

**pseudonyms Note. Pri = Primary; Sec = Secondary

The semi-structured interview schedule was in two main parts: first, the child's overall experience of school in general and of HBL; second, the child's perspective of effective HBL (See Appendix A). Their mothers who were the main care-givers at home during HBL were also interviewed separately to form a complementary picture of the child's experience (See Appendix B for interview schedule). The semi-structured interview approach allowed flexibility in pursuing relevant points such as awareness of assistive technology. Because of the social-distancing regulations during the time of the study, the 45-60 minute interviews were conducted online by the researcher after permission was sought and consent forms signed.

The interview data was transcribed verbatim. The data analysis was guided by the adapted ecological perspective, focusing on home and school contexts that might mediate the child's experience. This approach guided in developing the a priori codes which were used in the initial coding (See Table 2).

Table 2 Initial Coding Template

Categories	Codes	Notes (and examples)
Technology	T	Platforms / affordances mentioned (video conference platforms)
- help	T+	Specific mention of help (replaying video if unsure)
- hindrance	T-	Specific mention of hindrance (Wifi problems)
Pedagogy	P	Approaches adopted by teachers to facilitate learning (clear instructions)
- help	P+	Specific mention of help (additional support through unofficial channels)
- hindrance	P-	Specific mention of hindrance (lack of detailed feedback)
Child	C	Characteristics of child (with regard to dyslexia)
-help	C+	Characteristics of child that helped enhance HBL (self- directed, organised)
- hindrance	C-	Characteristics of child that hindered HBL (keyboarding skills)
Family	F	Immediate family members (father, mother, siblings)
- help	F+	Specific mention of help (resolving problems with tech or homework)
- hindrance	F-	Specific mention of hindrance (close supervision)
Larger Context	LC	School / national educational policy, after-school commitments (e.g., private tuition)
- help	LC+	Specific mention of help (exemption from some subjects)
- hindrance	LC-	Specific mention of hindrance (national exams end-of-year)

These codes were suggested by the review of literature. The two researchers coded and analysed the data separately before discussions regarding the coding template. New codes that arose from the data were subsequently added (e.g. pace). These codes were subsequently collated into potential themes which were also constantly revised before being finalised.

FINDINGS

This section will begin with an overview of each individual case, highlighting one particularly memorable incident (to student or mother) and other relevant factors that will contextualise their HBL experience. This is followed by the findings that cut across the cases, organised around the factors that were suggested by the ecological perspective adopted: school (specifically use of technology and pedagogy), home and larger contexts.

The section will end with a summary highlighting the themes that surfaced through analyzing the interaction among these various factors.

CASES

Lee is an 11-year-old girl who was sent for diagnosis when she was 6 years old because her mother was concerned that though she was very vocal, she could not read nor write. The intervention at DAS helped her to improve her confidence. However, according to her mother, though Lee can understand, she has difficulty remembering what the teacher said in class, including instructions. Hence, she needs constant reminding and repetition. Also, she has difficulty in presenting her understanding in written form. The mother highlighted an incident that happened years ago when a Mathematics teacher wrote "It's a fluke" against Lee's correct answer because Lee had not shown the required working. It helped explain why Lee kept reiterating during the interview that teachers must allow for different ways of answering questions. Perhaps, her concern arose also because the Mathematics teacher who taught her during HBL was not her usual class teacher.

Arun is a 12-year-old boy who is a middle child. According to his mother, he is very much left to his own devices and has thus grown to be quite independent, especially after achieving vast improvement in reading through DAS intervention. The mother shared that recently, she had more complaints from his teachers about him being distracted in class and not handing in work. In contrast, he has been very enthusiastic in HBL. In fact, he remarked that HBL has "made (him) smarter- suddenly, I know all the answers to everything". The boy had also taken the initiative to arrange additional one-to-one pro-bono tuition sessions in Math. While he appears to be fully engaged in one-to-one Math tuition and small group online DAS classes, his mother remarks that he is often distracted in his school online classes, often observed to be folding paper at the side, out of view.

Ian is a 13-year-old boy who was away from school for two months before the onset of HBL because of surgery on one of his fingers. As such, he was quite lost initially during HBL, especially in being acquainted with logging in and other instructions that would have been conveyed in class lessons before HBL. He was particularly upset at the technological hiccups that caused one teacher to broadcast to the class that he had not handed in work when he already did. However, being away from school for a long period gave him time to learn other things like card tricks and even experiment with coding. Still, he said he would rather go back to school, because in HBL, you "cannot ask questions- cannot see the teacher- like a lot of difference- if you have a question- you cannot tell him immediately- you have to wait".

Tia is a 16-year-old with a positive outlook, probably because her mother told her from young that "You're not stupid, you're just different" especially after hearing unkind remarks by her peers or cousins when she could not read simple words. Her mum finds that Tia is an independent and disciplined learner who can be entrusted with her own laptop in her room. Hence, her mother generally left her alone so that she could attend to her 12-year-old son who is also dyslexic and sitting for national examinations in the same year. Tia's main frustration is that she is "super slow" in writing because when she writes, she finds her thoughts "very scattery" as she struggles to put pen to paper, conscious that writing is not as easily editable as in typing. She recounted one incident when everyone else had finished their work and left the room, she was still struggling to finish.

FINDINGS ACROSS CASES

Technology

Online platforms were key during HBL. Before the physical schools closed, students were issued with a timetable (See example in Figure. 1). During the time indicated, students generally met their teachers online via video conferencing tools such as Zoom.

Sometimes, they would be directed to engage in online activities on the SLS platform. The platform would also help remind the child of work assigned and his or her progress in the required activities (e.g., "In progress" and "Completed").

These activities generally involved watching a video recorded by the teachers themselves or from another source such as YouTube. Students are often required to complete a set of Multiple-Choice Questions (MCQ) to check on their understanding (See Fig. 3). The younger participants mentioned more engaging activities such as Kahoot and simulations.

0730 to 0800					0800 to 0830					0830 to 0900					0900 to 0930					0930 to 1000					1030 to 1100					1100 to 1130					1130 to 1200					1200 to 1230					1230 to 1300					1300 to 1330				
Mon	Assembly	Class Meeting	Art		English (EL)		R E C E S S					Maths					PA					EL					Mother Tongue Language (MTL)																											
Tue	Maths					MTL						Science					EL					Physical Education																																
Wed	Performing Arts (PA)					PE						Music					EL					MTL					PE					Maths					EL																	
Thu	Catholicism (PC)					EL						Science					MTL					Maths					Character Education																											
Fri	EL					Character Education						MTL					Science					EL					Maths																											

Figure 1. Lee's timetable during HBL

Science (SLS)	<ol style="list-style-type: none"> 1. Get ready with your SLS details. Log in to SLS 2. Click on "'P5 All Sci HBL (29 Apr)' and complete the activities. 3. Click on Activity 1 'Quiz on Water and its changes of states' and complete the quiz. 4. Click on Activity 2 'Review answers of Science workbook (systems) Activity 4.2, 'Parts of a cell' page 29 and complete corrections. 5. Click on Activity 3 'Vitamins Cells' and complete 'Knowledge check- in and MCQ section only' 	1hr
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Figure 2. Example of SLS activities.

It was observed that much of the instruction communicated was written. Ian's mother noted:

"I think he struggles on HBL sometimes there is no clarity as teachers don't really tell them what to do. Everything's on screen so he has to read up and understand, and decipher what they want. So it takes a lot of time. Whereas if you are in school, your teacher will explain to you what you are supposed to do before they give you the work. Now he has to read it himself, understand himself, cos there's no teacher zooming in, coming in and telling you what to do. So I guess that is the downside to having HBL at home."

Apart from the official channels where the HBL was taking place, there was also a very active informal feedback channel via Whatsapp. Every child/parent pair mentioned how Whatsapp was used: teacher sending questions to students who in turn took photos of their answers to send back (Lee), students trying to alert teacher that they needed more time to complete their offline work (Tia), student trying to clarify something on group chat (Ian), teachers giving feedback to parent on child (Arun).

As expected, participants reported some teething problems in the use of online lessons as expressed by Tia:

“Sometimes SLS could be really buggy. A bunch of times, our teacher sent a bunch of things but it never went through. So we all sat down for an hour waiting for our assignment, but they never showed up. We started texting our teacher, and asking what happened. For some reason there was some lag, the whole country is trying to get into one single thing, and it’s making a mess. Everybody is just waiting.”

Other interferences could come from the home environment, for example, “trucks moving outside” (Lee).

In addition, typing also proved to be an additional hurdle to two participants, Ian and Lee. Based on the last CBA assessment conducted at the DAS, their Reading and Spelling scores placed them at the Beginning-to-Intermediate stage of literacy achievement. Lee reported, “I am bad at typing because when I do typing I keep on getting typos also so I don’t like...” Ian’s mum explained it as such: “It takes a lot of preparation time to write out things (which Ian prefers to do) and put it inside the keyboard. So it’s double work for him. So it becomes very tiring, and time consuming”.

There was also no evidence suggesting the use of dyslexia-friendly applications such as Speech-to-Text or Text-to-Speech. When asked if she was aware that she could use it to help her with spelling and typing, Lee said, ‘No you can’t do that, you have to type it out yourself’ and that she had never used it before.

In contrast, Tia who is placed at the Intermediate-to-Advanced stage of literacy achievement based on her Reading and Spelling scores attained on the last DAS CBA assessment, said:

“so when I type I know what I am writing so I don’t have to cancel out things, I can just type, and then like delete. So it’s always there if you need to change. But when I am writing, I need to be very sure of what I am writing, because when I am writing, I feel so scattery, and I feel so distracted, I am so easily distracted I can’t write properly.”

Participants recognized other advantages in using technology. Arun, who has problems with transposing, found that with the iPad, it is *“easily copy and paste important information, to see, to make the questions easier to understand”*. Tia found recorded videos helpful because she *“could just go back and rewatch the videos if (she) didn’t understand”*.

PEDAGOGY

As mentioned, teaching during HBL generally consisted of recorded videos or video conference sessions. The latter often involved teachers giving the correct answers to homework that was assigned to be completed offline. Students were then asked to mark their own work. If needed, homework was submitted through an online platform like Google Classroom where the teacher could track who had submitted and who had not. Occasionally, teachers gave feedback through the same channel. This combined approach of offline and online engagement could be partly attributed to a commitment by the ministry to limit the amount of screen time especially for the younger students.

Pre-recorded lessons met with mixed reviews. Tia liked her chemistry teacher’s flipped classroom approach, where students watched videos on the new content before attending the online class when they could raise questions directly with the teacher. In contrast, Lee did not find such pre-recorded videos nor online teaching helpful because she felt that they *“did not go in-depth”*. She felt that she could not *“actually go up directly”* and *“can’t really ask questions”* when in doubt. Similarly, while the multiple-choice questions or the fill-in-the-blanks assignments which she had to attempt on SLS could give her immediate feedback on whether her answers were correct, they *“don’t actually explain”* why she was right or wrong.

What was conspicuously missing was class discussion where learners could collaboratively construct their understanding. Instead, the student participants mentioned how the teachers would mute everyone during their lesson. While this meant they could *“hear more clearly”*, the approach resulted in passive listening. This led the interviewees to tune out at best; at worst, they were frustrated at the lack of opportunity to clarify. There were tools for the students to signal their questions but as Ian said, his hand had been *“virtually”* raised for two weeks and yet the teacher had not responded. When Tia’s class tried to ask for more time to complete class work, it was too late by the time the teacher saw the Whatsapp message. Tia highlighted that this would not have happened in school where the teacher would have seen for himself that the class was generally struggling.

It thus appears that one commonality in the participants’ experience centred around feedback: both in the giving and receiving of feedback. In contrast to the immediacy of response afforded in a typical lesson in school, the student-teacher interaction was hampered by the online environment during HBL. As one mother remarked, *“You can’t*

see their expression as much and what they are doing behind your back". Teachers could have used the technological tools to enable better interaction or feedback. But there was little evidence of the technology used in such a way to support pedagogy.

One last point worth noting is that it was unanimous that even if the teachers knew of the students' conditions, teachers did not differentiate their pedagogy and feedback approach to accommodate the needs of the dyslexic students. Lee mentioned that "...school is in general for most students so we don't really understand sometimes ... usually they will just say it once and then they will go with the majority if they need to go through it over again." What this suggests is the propensity of teachers to adopt a whole-class approach in the teaching of content and if such is the case, the same would probably have been undertaken for product and assessment of learning. Perhaps, the differentiation then might have come through the feedback to the individual child based on their knowledge of the child's needs. Even so, Arun remarked that the approach to feedback was "the same" in school and HBL. In Lee's case, the teacher who taught her Math during HBL was not even her regular subject teacher. The students were allocated to different groupings on the basis of their performance in the subject. Lee reported that she could not understand "the different explanation" of this unfamiliar teacher. As a result, the learning process for her became rather fragmented, which could then exacerbate confusion. It could be that the drastic transition to HBL might have left teachers with little time to plan for differentiation. Much effort would have been focused on exploring the different applications and tools to enable effective delivery and converting content to the digital format.

Parents

Since HBL took place when the parents were also working at home, the interviewees had their parents' help when they encountered difficulties. These difficulties were often technical in nature: how to log in, photograph their assignments to be submitted online (or "pdf it" as the interviewees said turning the noun into a verb). At other times, the mother had to monitor if work assigned was done or checked, especially when they considered the children to be disorganized (e.g., Lee and Tia's younger brother). In some cases, the parents played the role of the teacher to explain content (Tia's engineer father explaining mathematics) or assisting with the homework (Ian's mother reading out the question for him, Lee's mother breaking down the problem in steps for her). In many ways, the parents played a significant role in mediating the child's HBL experience. Previously, they had always availed themselves if their children asked for help but during HBL, they took greater steps and time to support them.

A theme that came across all the different cases was how the parents were a source of affirmation for the participants. Since young, the parents used positive talk to help their dyslexic children when the latter struggled with learning. One example is by Tia's mother that there was nothing wrong with her but that her pathway was different: "If people go

route A to study, you have another route to study." Lee's mother's constant message to her child was to accept she had dyslexia and to always try her best. In fact, the mother emphasized to Lee that she should not use her condition "to her advantage", an excuse for not trying.

Larger Context

Apart from the parents, this group of participants benefited from a larger network of support: the DAS and sometimes, additional tuition outside of school. As such, what the students missed out in the individual attention from school, they could access through these other teachers. They also benefited from the policy that exempted them from learning another language. In Singapore, apart from English Language, all students must learn a second language. The latter, termed their Mother Tongue Language (MTL), is determined largely by the child's ethnicity. For example, children of Chinese race are likely to study Chinese Language as their Mother Tongue. This study found that three of the four participants were exempted from learning MTL because their parents had requested it on account of their child's dyslexia. Because of this, the participants had one fewer subject to study.

Consequently, they enjoyed less homework than their classmates and at least one free hour which was the allocated slot on their timetable for MTL. On a normal school day, the participants would still be physically present in class and so their hours in school were just as long. However, because they were at home, the participants could sometimes get on with other assigned work and so finish earlier. In all, the parents reflected that HBL was a bonus for the children because the hours were shorter and the pace was less punishing. Even for Tia who said that this was "needlessly stressful" year because of the looming national exams, her mother noted:

I see her smiling, taking time, going outside socialising with her brothers, even playing Monopoly. Yesterday I saw her sitting down playing Monopoly, I was like Tia, you're joining them? Usually she'll be cooped up in her room, she'll be doing her stuff, because you know rush. But yesterday she had time to be out. I said so good. She spending more time with the boys, which is very good for me. For me, there's always the pros and cons. For me, the pros is that I can see the kids relaxed, not as stressed out, have more time to breathe.

Arun's mother concurred that her child was often "wiped out" after a long day at school. In contrast, the pace was more comfortable during HBL. He seemed to be able to cope better, resulting in him feeling that he "suddenly know the answers to everything". His mum reported that even his teachers were pleased with his progress.

One contributing factor to such long hours was the other commitments after school, notably extra classes at DAS or tuition centres in one or more school subjects. Lee and

Tia's weekends also included enrichment or religious classes. So ironically, the participants' experience of HBL was enhanced by the suspension of these other activities due to social distancing measures.

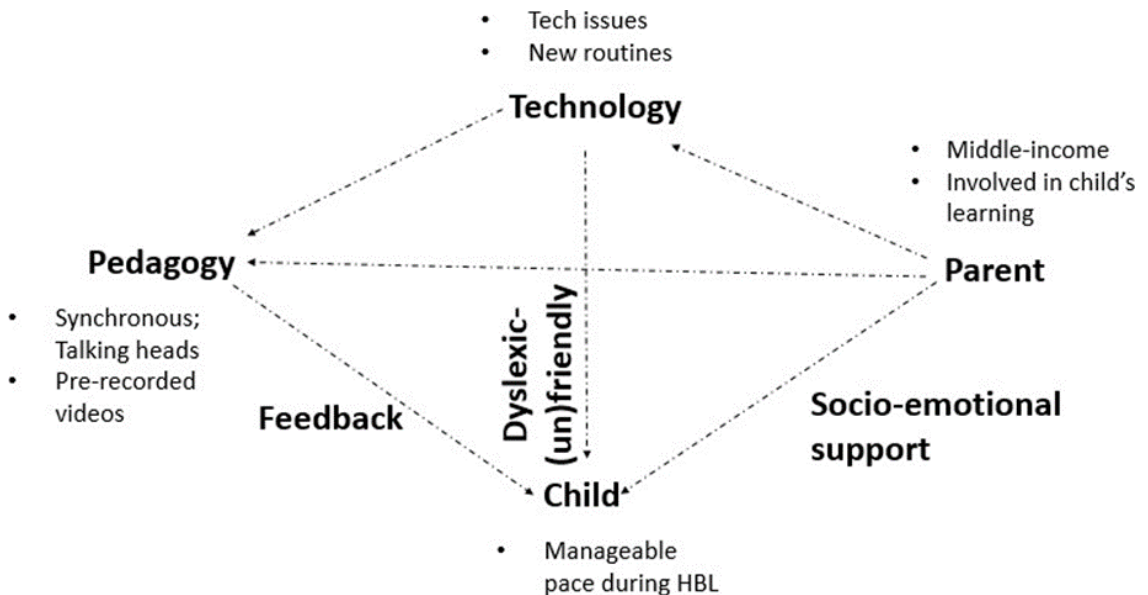


Figure 3. Summary of Findings

SUMMARY

The findings suggest that generally the participants in this study found HBL to be a positive experience. However, it was not due to how learning was enhanced by technology or the pedagogy used during HBL. In fact, all four participants preferred to be back in school because they missed the interaction with the teacher to clarify when in doubt. Instead, it appeared that they enjoyed HBL because of their supportive home background and the larger context of a less demanding workload. These factors and themes are summarised in Figure 3.

However, one hastens to note that these findings are in the context of participants who enjoy a middle-income background with extra classes outside of school. Their parents hold professional jobs (e.g., engineers) and their mothers are very much involved in their children's learning.

DISCUSSION

The study was set in an unprecedented month-long lock-down when schools were closed. Nevertheless, students continued to attend lessons in a distance e-learning mode, termed

locally as Home-Based Learning (HBL). This study aimed to investigate the experiences of dyslexic learners during HBL. The qualitative findings from interviewing both the learners and their mothers, as well as examining artefacts, revealed several key factors that will enhance the learning of such students: dyslexic-friendly use of technology, feedback-focused pedagogy and socio-emotional support. The following section will discuss each of these in detail, along with the attendant implications and recommendations.

Dyslexic-(un)friendly Use of Technology

Much has been said that our young are all digital natives who take easily to the use of technology (Prensky, 2001). This seems to be supported by the observations of the participants in this study. There were initial teething problems due to navigating the new routines involving the use of technology. However, they were more inconveniences than hurdles.

What proved to be more inhibiting was the typing required. The keyboarding skills expected added another hurdle on top of the difficulties dyslexics experience when expressing their thoughts in writing. It appears that one key intervention for dyslexic learners is to learn key-boarding skills (Beers, Berninger, Mickail, & Abbott, 2018). Herbert et al., (2018) also emphasised that using word processors would only be effective for dyslexic students if they had experience in keyboarding, otherwise it would greatly underestimate their writing skills. Alternatively, other technological affordances such as text-to-speech or audio submissions instead of text should be made more prevalent.

In the meantime, teachers should be more aware of the extra cognitive load placed on dyslexics with the current practices. There may be intangible barriers limiting rich communication, participation and optimum engagement (Lee, Song & Hong, 2019). Activities and tasks conducted in both synchronous and asynchronous modes of learning are mostly reading, writing and typing and rely quite heavily on memory, self-organisation and automatisisation skills. Thus, it would seem likely that some learners with dyslexia will have particular difficulties and will be disadvantaged to some extent. Unlike traditional classroom settings, synchronous environments may require students to toggle between browsers, windows and applications while focusing on texts presented, listening to explanation and instructions and typing responses almost simultaneously. These activities tend to exert additional cognitive load on learners with dyslexia who are already struggling with phonological processing difficulties, short term memory and retrieval skills. This can result in their integration processes being less efficient, often demonstrated in their much slower or delayed response, difficulties keeping pace with the rest of their classmates and understanding content taught. Having to process information coming from the various modalities and competing structures may impose additional pressures on their short-term memory, sequencing and organisation, which explains why they often have to spend many more hours in their own time, going through

notes and asking their teachers questions repeatedly (Beacham & Alty, 2006; Snowling, 2000; Woodfine et al., 2006). Frustrations may be further compounded with few opportunities to ask questions, clarify and seek help.

Apart from the above, something as innocuous as text fonts or colour or line spacing could also exacerbate the dyslexic's difficulty with visual processing (Rainger, 2003). It has also been reported that presentations containing text and diagrams may result in little retention of visual-verbal and non-verbal information due to pre-existing phonological processing difficulties and the potential for experiencing a split-attention effect (Sweller, van Merriënboer, & Paas, 1998). Ayres and Cierniak (2012) recommended that instructional designs should attempt to present information from two different sources (e.g. text and diagram) in an integrated manner to maximise retention and learning. This can be done, for example, by embedding written instructions within a diagram instead of presenting them separately or inserting audio text in a targeted picture.

Other dyslexia-friendly accommodations that teachers can make to instructional presentation and lesson delivery to help learners navigate online materials with much less frustration, would be to use a consistent and predictable screen layout with an uncluttered appearance. There should not be too many pictures or diagrams on the same page. Instead, teachers can put items in bullet points, number them in order or place important items in boxes. Should continuous prose be presented, it is highly recommended that an estimation of a finger spacing in between words and lines be provided and clear headings in between paragraphs be provided. O'Hanlon (2005) reported that learners who read passages with titles and headings were able to recall approximately twice as many items and had higher levels of comprehension than a control group which was given the same text but without any titles and headings.

In short, teachers should be encouraged to intentionally design online experiences that will not put dyslexics at a disadvantage (e.g. synchronous interactions). At the very least, our practices should do no harm.

FEEDBACK-FOCUSSED PEDAGOGY

Technology has sometimes been portrayed as a game changer for education (OECD, n.d.). Fullan and Langworthy (2014) also argue that technology can result in "deep learning". However, the claim is with the caveat that the technology is used with sound pedagogy.

This study suggests that one area teachers could have used technology more efficaciously is in supporting the feedback dialogue. We now know how important feedback is to improve learning (Hattie & Timperley, 2007; William, 2018). This is even

more important in the context of distance e-learning with the spatial or even temporal gap separating the teacher and learner.

While dialogic feedback may be conducted on synchronous modes of instruction, the same cannot be said of the asynchronous mode. Asynchronous modes are heavily dependent on students' self-monitoring skills as they are frequently required to do self-checking of completed tasks. For some activities such as Multiple-Choice Questions (MCQ), students would submit their completed work and receive an automated response. However, no explanation would be given for incorrect answers. Students will need to seek clarification from their teachers separately via email or text messages if they want to understand more. Unless teachers check their emails or messages frequently, students do not usually get an immediate response. For students with dyslexia lacking self-monitoring and organisation skills who do not independently make it a habit to seek, clarify and follow up with their teachers or peers, the gaps in understanding will widen if left unresolved.

Feedback that is effective in supporting and enhancing students' learning takes place in the form of a dialogic engagement between teachers and students (Tan & Wong, 2018). Dialogic engagement entails both learner and teacher actively interacting and communicating to reconcile and clarify differences. Hattie and Timperley (2007) recommended embedding feedback in the teaching and learning process, such as the teaching of specific learning strategies, to facilitate transfer of knowledge from working memory to long-term memory, for more efficient retrieval in future. This could be made available in synchronous modes but would pose a challenge if instructional sessions on the synchronous mode are held for classes with more than ten students. Feedback may not be specific and targeted to close the individual student's learning gaps or resolve errors or misconceptions. Owing to their cognitive processing differences, one-size-fits-all instructional pedagogy commonly practiced in synchronous online lessons may result in them spending more time and effort struggling to learn and significantly less knowledge retention than they currently experience using conventional approaches (Zeglen & Rosendale, 2018; Beacham & Alty, 2006). Although there are generally two teachers assigned to a class (Home teachers), there are only about two or three SEN teachers (termed as Allied Educators) supporting such students in the whole school. Home class teachers may not be trained to cater to the specific learning needs of these students.

To be fair, the sudden transition from physical classroom to online learning as a result of the Covid-19 pandemic left very little room and time for teachers to plan, prepare and adjust content and materials to suit the online platform. This could probably explain why pedagogy seemed to have remained status quo with teachers downloading information as they would in a live classroom setting. Apart from quick dip-stick self-assess quizzes using multiple choice questions, it did not appear that feedback featured very highly in the lesson interaction. In the HBL context, dialogic feedback had to be necessarily mediated by technology. One possible alternative is for teachers to hold and facilitate

separate, small group meetings on the synchronous platform where students can be given ample, uninterrupted time, attention and opportunity to ask questions and clarify and for teachers to share specific correctional and monitoring strategies tailored to individual students' needs. As this did not happen then, it was therefore a missed opportunity to harness technology to give more focused feedback especially for struggling learners including the dyslexics. Both schools and policy makers should study how this can be addressed in future episodes of HBL.

SOCIO-EMOTIONAL SUPPORT

It was clear that the family support mediated the children's experience of HBL. Research investigating effective online instruction has identified collaborative learning and strong instructor presence as key factors (Dixson, 2010). In distance e-learning, the absence of teachers, instructors or schoolmates with whom students may want to communicate with or seek clarification from could possibly trigger feelings of vulnerability over gaps in understanding they may not be able to address immediately. Feelings of isolation may intensify that could possibly lead to reduced self-efficacy and motivation. In the physical absence of teachers, the participants in this study were fortunate to have had their parents as alternative sources of support, guidance, assurance and affirmation - from explaining less understood concepts to helping with teacher communication and submitting completed assignments. Perhaps teachers could further support these students and their families by providing guidance and recommending suitable tools and applications that can help them better utilise online platforms to their advantage.

LIMITATION AND FUTURE RESEARCH

As indicated in the earlier section, the participants of this study came from generally comfortable family backgrounds. They were able to afford classes at DAS, even without financial support in two cases. The parents were supportive and encouraging. Hence, it is harder to extrapolate the findings to other contexts, particularly with children who are less well-off. It is tempting to infer that the latter would have a less positive experience of HBL. However, whether this is a valid inference remains unclear without another study focusing on this other student group. Such a study will uncover the impact of HBL and perhaps other contributing factors that hinder their learning. It will be an important input for policy-makers who may be contemplating more extensive use of distance e-learning. Singapore, for example, has already decided that HBL will become a regular part of student life (Ang, 2020).

In particular, they should be sensitive to the different levels of parent or caregiver efficacy in how they are managing the family's financial situation, nucleus, work arrangements and involvement patterns concerning academic support for their children (e.g., extra lessons at DAS). These factors would potentially impact students' access to learning, motivation and engagement differently. For example, students whose parents

have financial constraints may not be able to afford the technological access. The same goes with large families having more than three or four school-going children requiring separate devices and Internet connectivity to access HBL should they have to do so at the same time. Unlike non-working parents, those who are working from home are also juggling multiple responsibilities and roles to manage their day-to-day affairs, including that of their children's educational needs. Outcomes would conceivably differ for parents with little efficacy to provide the necessary technological, literacy and academic support for their children with dyslexia and possibly other specific learning needs. Such situations would certainly necessitate a collaborative and co-ordinated system of support involving both school and social agencies.

CONCLUSION

In our efforts to provide greater accessibility and promote inclusivity for all in both conventional and online education, there is a need to look into whether students who face challenges in traditional classes (including those with dyslexia) will struggle even more in the online learning environment, and if so, what reasonable adjustments can possibly be made?

The present study highlights two possibilities: dyslexic-friendly use of technology and feedback-focused pedagogy. In addition, socio-emotional support is also important; if not provided for by the family, then by the school context. It is worth noting that these accommodations do not disadvantage non-dyslexics either. Indeed, these supports offer benefits to others as well, with "access for everyone" (O' Hanlon, 2005; McCarthy et al., p. 151), thus providing all students the best opportunities to succeed in this new normal of distance e-learning.

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APPENDIX A

Semi-structured Interview Schedule (Students)

Research Question:

"In what ways does distance e-learning help or hinder the dyslexic student".

I. Introduction

- ◆ The focus of this interview is your experience of Home-Based Learning. The purpose is to help me understand what usually happens in HBL. Then I will write a report so that others can understand how to design better HBL.
- ◆ It is not part of your assessment and what you say will be kept confidential and not be communicated to your classmates or teacher. When I write up about this study, nobody will be identified by his/her real name.
- ◆ You can stop the interview anytime.

II. Your school / HBL experience

- a. Tell me a little about lessons in school. What do you like most / least.
- b. Tell me about HBL. Do you enjoy them? Why / why not?

III. Your ideas on good HBL experience

- a. Let us now discuss one HBL which you liked. What did you like about it?
- b. How does HBL at DAS compare with the HBL from schools? Which do you prefer and why?
- c. How same / different is HBL lessons across different subjects?
- d. Do you prefer the use of e-learning? Or hardcopies (e.g. textbooks, printed worksheets)? Or classes at school? Explain your choice.
- e. What can teachers do in HBL that will really help you?

IV. Any other information

Please feel free to tell us anything else important about HBL that we have missed out on.

Thank you for your time.

APPENDIX B

Semi-structured Interview Schedule (Parents)

Research Question:

"In what ways does distance e-learning help or hinder your child with dyslexia?"

I. Introduction

- a. This interview should last approximately 45-60 minutes.
- b. The focus of this interview is the home-based learning (HBL) experienced by your child. The purpose is to help me understand what has helped or hindered learning.
- c. Any information you give will be kept anonymous and you will be assigned a pseudonym. The recording we are making will be used for transcription purposes and it will not be heard or played back for anyone not directly involved in the research.

II. Background

- a. Tell me a little about your child (name of child with dyslexia).
- b. How is your child's experience of school in general?

III. Child's HBL experience

- a. What have you noticed of your child during the HBL period? More stress? Happier? Why?
- b. Which were the HBL lessons / approaches that were more effective for your child? Why?
- c. (We will also discuss some points raised by your child during his/her interview for your input).

IV. Closing

Any information that you feel that we should know about HBL but was not raised earlier?

Thank you for your time.