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Exploring progressive applied behavior analysis through the lens of technology use among students with autism in an autism primary school in Hong Kong

Exploring Progressive Applied Behavior Analysis through the Lens of Technology Use among Students with Autism in an Autism Primary School in Hong Kong

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Abstract

Interventions based on the principles of applied behavior analysis (ABA) and technology have been increasingly used to support individuals with autism. This research aimed to investigate progressive ABA, the benefits and issues of using screen-based media among students with autism, and how teachers manage technology use and related problems in an autism primary school in Hong Kong. Four studies were conducted in this research, including (1) focus group interviews with two teachers, (2) classroom observations with eight teachers and twelve students, (3) individual interviews with four teachers and (4) questionnaires with eight parents. Many benefits were identified in this research, such as enhancing knowledge, improving on-task behaviors, increasing engagement, promoting skills acquisition, verbal communication, social, play skills, generalization for students and being user-friendly for teachers. Issues were also observed, including increases of stereotypic behaviors, non-compliance, temper tantrums, inattention, online risks and social issues. Management strategies upon the occurrence of challenging behaviors were found, for instance, reprimand, removal of preferred activities, minimal attention, physical enforcement, and redirection. More, management should focus on teaching students to follow directions, self-monitoring, and other alternative behaviors with the use of verbal reminder, timer, and tokens. This research showed that technology is not a replacement for teachers and traditional teaching materials. It is a supplementary tool that has both positive and negative impacts to students, depending on how technology was being used. Screen-based media can enhance ABA-based teaching when teachers apply ABA principles and knowledge progressively with a great deal of clinical sensitivity, flexibility, critical thinking, delicacy and understanding of the students' characteristics and needs.

Author's Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's *Regulations and Code of Practice for Research Degree Programmes* and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

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Chapter One: Introduction

Applied behavior analysis (ABA), autism and technology have been my life and passion for over 20 years. People's understanding and perceptions of autism have been changing as the definitions of the condition were revised for several times. Some of the most empirically supported and commonly used interventions for students with autism are models based on the theories and principles of ABA. ABA is a controversial topic—it has many advocates as well as opponents who continue to debate how and whether or not it should be used for people with autism. Fast-developing technology has also been reshaping the lives of autistic children in both positive and negative ways depending on how it is being used. This research aims to investigate progressive ABA, the benefits and issues of using screen-based media among students with autism, and how teachers manage technology use and related problems in an autism primary school in Hong Kong. Chapter Two describes autism including its history, definitions, prevalence statistics, screening and diagnosis, as well as the social and behavioral characteristics of autistic individuals. Chapter Three discusses the definitions of ABA, research supporting ABA's effectiveness, research against the effectiveness of ABA, and further critiques of ABA. Chapter Four gives the details of the research setting—an autism primary school in Hong Kong—including general information about the school, as well as its purpose, history and characteristics. Chapter Five reviews the literature regarding the use of screen-based media among students with autism. The use of technology, benefits, issues, and management of technology use will also be discussed. Chapter Six relates the methodology of the four parts of this research, including a focus group interview with two teachers, classroom observation with eight teachers and twelve students, individual interviews with four teachers and questionnaires with eight parents. It describes the aims and research questions, research design, participants and data collection, data analysis, ethical considerations, limitations and difficulties. Chapter Seven presents the

results in terms of the benefits, issues, and management of technology use in the classroom. Chapter Eight further discusses the findings in relation to the research questions under the following sections: uses of technology; impacts of technology in the classroom; attitudes to technology use; the relationship between technology and behavior; progressive ABA; limitations; and conclusion.

Chapter Two: The Autism Spectrum

Autism is a complex condition, and those on the spectrum demonstrate various social and behavioral characteristics (American Psychiatric Association, 2013). People's understanding and perceptions of autism have been changing over the past 70 years, and the definitions of the condition have been revised several times (American Psychiatric Association, 1980, 1987, 1994, 2000, 2013). Autistic individuals often have varying views on how autism should be described, with differing preferences for terms like 'individuals with autism', 'autism spectrum disorder' or 'autistic'. This chapter will give an overview of autism including relevant terminology, its history, definitions, prevalence statistics, screening and diagnosis, diagnosis in Hong Kong, as well as the social and behavioral characteristics of autistic individuals.

Autism Terminology

In Hong Kong, there are different terms in Cantonese used to describe individuals who have been diagnosed with autism, such as "A child" and "Star kid" for autistic children and "A guy" for autistic adults. In 2018, I hosted a radio program with a group of adults with autism on Radio Television Hong Kong (RTHK). The program was called "A Child? A Guy!". We invited many autistic people to share their stories to raise awareness of and encourage care for the autistic community. In the United States, the term 'students with Autism Spectrum Disorder (ASD)' is commonly used possibly because 'Autism Spectrum Disorder' is the term that appears in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013). Kenny et al. (2016) conducted an online survey to find out the views and preferences of the United Kingdom autism community regarding the terms they use to describe autism. The study received 3470 responses from UK residents. The results showed that there is no universal term to describe

the condition. The term ‘autistic’ was endorsed by most autistic adults and the term ‘person with autism’ was mostly preferred by professionals.

I have been working in the field of autism for over 20 years across 10 countries with Autism Partnership (AP), a private service provider using interventions based on the theory and principles of Applied Behavior Analysis (ABA) for students with autism. In this study, I often use the term ‘person with autism’ instead of ‘person with ASD’. I do not use the term ‘disorder’ because I see autism more than just a disability or disorder. Instead, I see autism is an ability: an ability to make an individual focus on details, remember patterns, complete boring jobs; an ability to be honest, loyal, punctual, 100% determined, self-contented and to be a real person. I believe that autistic individuals have high learning capacity. With effective early intensive intervention, they can make remarkable progress. On the other hand, I also use the term ‘autistic’ as some autistic people and their family members prefer the term ‘autistic’. They see autism as a big part of their identity as a person on the spectrum (Kenny et al., 2016). In 2020, an Australian reality television show called “Love on the Spectrum” first streamed on Netflix. It followed a group of young adults on the spectrum on their journey of seeking love. I was really impressed by how the individuals on the show presented themselves as who they are. They sometimes described themselves as a person ‘on the spectrum’; on some occasions they referred to themselves as an “autistic adult” or a “person with autism”. Since there is no universal term to describe autism, in this research I use these different terms flexibly to describe those who have been diagnosed with autism.

History

Autism is a behaviorally defined neurodevelopmental disorder. The definitions of autism have been changing over the past 70 years. In 1943, Leo Kanner described 11 autistic children’s behaviors as “governed rigidly and consistently by the powerful desire for aloneness and sameness” (p. 249). Subsequent publications reported more cases of “early

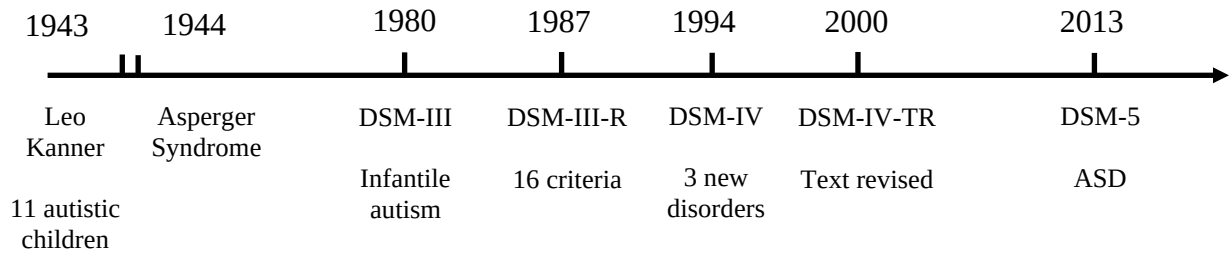
infantile autism" with similar primary symptoms of disturbance in affective contact and profound withdrawal (Eisenberg, 1956; Eisenberg & Kanner, 1956; Kanner, 1944). In the 1960s, empirical evidence started to suggest that other symptoms like language deficits and intellectual shortcomings were the basic key markers in autism (Frith, 1970; Lockyer & Rutter, 1969). By the early 1980s, the perception of autism was largely influenced by the introduction of people who met the criteria for Asperger's (Wing & Gould, 1979) and the argument that the essential characteristic of Kanner's cases and Asperger's cases was an impairment in two-way social communication (Wing, 1981a; Wing, 1981b).

When Infantile Autism (IA) was included for the first time in the third edition of the Diagnostic and Statistical Manual (DSM-III) in a class of conditions called pervasive developmental disorder (PDD), the diagnostic criteria were "pervasive lack of responsiveness to other people; gross deficits in language development; peculiar speech patterns, if speech is present at all; bizarre responses to the environment; and an absence of delusions, hallucinations, loosening of associations, and incoherence as in schizophrenia" (American Psychiatric Association, 1980). After seven years, the criteria for autistic disorder in the DSM-III-R, a revision of DSM-III, were broadened to a detailed set of 16 criteria grouped in three broad areas including social, communication, and imagination difficulties (American Psychiatric Association, 1987). In the DSM-IV, the definitions of autism had a good balance of sensitivity and specificity across IQ range and age with many (but not all) behavioral characteristics in common. Four new disorders were recognized, including Childhood Disintegrative Disorder, Asperger's Disorder, and Rett's Disorder along with Pervasive Developmental Disorder- Not Otherwise Specified (PDD-NOS) (American Psychiatric Association, 1994).

Volkmar and Reichow (2013) criticized the definition of Asperger's as most problematic among these newly-included conditions. Some researchers even concluded that it

is impossible to diagnose Asperger's disorder using DSM-IV criteria (Mayes, Calhoun & Crites, 2001; Szatmari et al., 1995) because of the significant overlaps of the core diagnostic criteria among Asperger's disorder and autistic disorder. The content of Asperger's disorder was revised in the DSM-IV-TR (American Psychiatric Association, 2000), a text revision of DSM-IV. In DSM-5 (American Psychiatric Association, 2013), Asperger's disorder, together with Childhood Disintegrative Disorder, Rett's Disorder and PDD-NOS were all removed. 'Autistic disorder' was no longer used, and the condition is now called Autism Spectrum Disorder (ASD).

Autism History



Current Definitions

Nowadays, autism is often conceptualized as a spectrum. Different individuals of the same age with the diagnosis display different social and behavioral characteristics. Yet they share the similar core diagnostic features of, according to DSM-5, "persistent impairment in social communication and interaction; restricted repetitive pattern of behaviors, interests, and activities; symptoms must be present in the early developmental period; symptoms must cause clinically significant impairment in social, occupational, or other important areas of current functioning; and these disturbances are not better explained by intellectual disability or global developmental delay" (American Psychiatric Association, 2013, pp. 50–51). One of the big changes on autism in DSM-5 is the inclusion of hypo- or hypersensitivity to sensory stimuli. Sensory features have been noted in many individuals with autism since Kanner first

began studying the condition. However, sensory sensitivity was not included in the diagnostic criteria of autism until the DSM-5, possibly because sensory issues and problems are not unique to autism. Grapel, Cicchetti and Volkmar (2015) conducted a study to compare the frequency of sensory-related issues between individuals with autism and individuals with other developmental disorders such as PDD-NOS, language disorders, and learning disabilities. Data from a sample of 776 school-age adolescents and adults were tested and diagnosed using the DSM-IV-TR. The results suggested that sensory features have relatively poor power to discriminate between autistic and non-autistic groups.

Prevalence Statistics

The prevalence of autism has increased over time. Population-based epidemiological studies in the United Kingdom reported an increased prevalence from 30.8 per 10,000 (1 in 324) in the year 2000 (Baron-Cohen et al., 2000) to 157 per 10,000 (1 in 64) in 2009 (Baron-Cohen et al., 2009). In 2018, the Center for Disease Control's Autism and Developmental Disabilities Monitoring (ADDM) Network estimated that in the United States of America about 1 in 59 children has been diagnosed with autism (Baio et al., 2018). The US prevalence rate increased to 1 in 54 in 2020 (Maenner et al, 2020). The authors showed that the percentage of children aged 3-17 years diagnosed with autism in the United States increased from 1.1% in 2009-2011 to 2.5% in 2015-2017. It should be noted that ‘prevalence’ refers to the rate of people who have been diagnosed with autism, which is different from the actual rate of people who have autism. This is because some people with the condition may not have access to diagnostic services, and some may have been misdiagnosed. Even though the autism prevalence rate has increased in the past few decades, it is uncertain whether the real number of people with autism has historically increased. The increase in prevalence rate may be due to increased awareness of autism, more provision of professional services, and the change of diagnostic criteria (Wright, 2017).

According to a report from the Centers for Disease Control and Prevention (CDC) in the United States (Maenner et al, 2020), autism occurs in all racial, ethnic, and socioeconomic groups. Yet some European studies suggest a link between low socioeconomic status and higher diagnosis of autism (Delobel-Ayoub et al., 2015; Maenner et al., 2020; Loomes, Hull & Mandy, 2017). Delobel-Ayoub et al. (2015) recruited 500 children with autism in France to investigate the association between socioeconomic background and autism. Results demonstrated that the prevalence of autistic children with intellectual disabilities was higher in the area with the highest level of deprivation and the highest percentages of unemployed adults, persons with no diploma, immigrants and families with single parents. The authors did not investigate the reasons for these findings. Nevertheless, I would not necessarily assume that parenting issues are the main factor affecting the prevalence of autistic children with intellectual disabilities. The exact cause of autism is unknown, and there are many possible causes for a higher prevalence, including genetics, environmental influences (Bai et al., 2019), more awareness and a higher frequency of diagnoses (Maenner et al., 2020).

Maenner et al. (2020) showed that the prevalence of autism is about four times more common among boys than among girls. However, evidence suggests that autism is underdiagnosed in girls. Loomes, Hull and Mandy (2017) conducted a systematic review to investigate the proportion of autistic males and females in the UK. The findings suggested that the male-to-female ratio of autism is lower than previously assumed because of several possible reasons: for instance, the autism characteristics for females are different from the conventional conceptualization of the condition, autistic females are less likely to show their restricted interests to others, and females are more likely to mask their autistic difficulties.

The CDC reported that about 33% of children with autism were classified as having an intellectual disability with an IQ of 70 or below (Maenner et al., 2020). However, it should

be noted that the findings of the CDC are subject to several limitations. First, the methods relied on limited existing documents in education records. Second, inaccessible and incomplete records could lead to an underestimation of prevalence. Third, the number of sites included in the study did not cover all 50 US states and the data only represented the number limited within the nation.

In Hong Kong, there is a lack of academic studies exploring the number of people who have been diagnosed with autism. Sun et al. (2013) conducted a systematic review and meta-analysis to synthesize the evidence relating to the prevalence of autism in China, Hong Kong and Taiwan. Twenty-five studies were identified eligible for review. The research concluded that the prevalence estimates of autism in Greater China are lower than estimates from western countries such as the US and UK. Sun et al. (2019) conducted another study to compare the autism prevalence between China and western countries. The results showed that the average prevalence from three cities in China was about 56 per 10000 (1 in 178), reflecting under-diagnosis compared to the west. However, the above study did not include Hong Kong, which is the relevant setting for this research. In Hong Kong, the Education Bureau claimed that the number of students diagnosed with autism in ordinary (mainstream) schools has increased from 2,050 to 4,970 from 2009/10 to 2013/14, the number more than doubling in four years. In 2018/19, the prevalence further increased to 9537. Many of these children had average or above intelligence and are attending ordinary schools. Sadly, a more updated number of autistic students in ordinary schools is not available for more recent academic years. The Autism Hong Kong Society estimated that the total number of autistic people in Hong Kong was about 75,000 to 113,000 in 2019 (Autism Hong Kong, 2020). However, the number was an estimated figure based on the prevalence rate of autism in the United States.

Screening and Diagnosis

Autism is a behaviorally defined syndrome. There is no identified biomedical marker common to all autistic individuals (Hayes et al., 2018; Klin, 2018). Autism can be diagnosed reliably at the age of two (Lord et al. 2006). However, diagnosis at any age can be difficult to confirm because it cannot be examined by a medical test or blood test. Doctors and psychologists make the diagnosis based on the child's developmental history and direct observations of behaviors (CDC, 2020). Moreover, research suggested that diagnostic procedures are not consistent across all practices. There are multiple variables affecting diagnosis, included social factors, selection of diagnostic tools and process, diagnostic uncertainty, and judgment (Hayes, Ford, Rafeeque & Russell, 2018). Crane et al. (2018) conducted a study to examine the views and experiences of 10 autistic adults, 10 parents of autistic children, and 10 professionals involved in the autism diagnostic process in UK. The results identified that the routes available for accessing an autism diagnosis were uncertain, inconsistent and vague; the diagnostic process was challenging, difficult and tiring; and the post-diagnostic support provision was inadequate. Leedham, Thompson, Smith and Freeth (2020) explored the lived experiences of 11 female adults diagnosed with autism. The participants found the diagnostic experience exhausting for various reasons: the assessments were intensely emotional, their experiences were not understood by professionals, and the failure to find understanding added to the sense of confusion. These findings suggested limited understanding of autism diagnoses, which contributed to delayed assessments and possible misdiagnoses.

Diagnosis in Hong Kong

Hong Kong has a population of over seven million (Census and Statistics Department, 2020). The Department of Health operates seven Child Assessment Centers (CAC) for children under the age of five years with suspected developmental disabilities. For children over the age of six years, they are referred to the Student Health Service. In 2013, the CAC

received 8775 new clients and total of 62,011 assessment sessions were conducted (Hong Kong Department of Health Annual Report, 2014). However, no statistic for autism diagnosis was provided from the report. Tait et al. (2016) conducted a study to find out the experience of Hong Kong Chinese families' experiences of autism diagnosis. The study received 75 survey responses from parents, and 45 parents participated in semi-structured interviews to share their diagnostic experiences. The results indicated that the parents think that the pre- and post- diagnostic services in Hong Kong are limited and expensive. The parents' perspectives of their child's condition is also influenced by their cultural background, which contributes to a fear of community stigma and a feeling of shame. As a result, seeking diagnosis becomes a very stressful and confusing time for parents in Hong Kong (Tait et al., 2016).

Characteristics

Understanding more about the behaviors and socialization of autistic people may help teachers to provide them with better educational support. This section will discuss the social and behavioral characteristics of autistic individuals.

Social characteristics. Autistic individuals are characterized by their uniqueness in social skills. Difficulties with social communication and interaction constitute a major diagnostic feature of children with autism (American Psychiatric Association, 2013). Social communication refers to the social aspects of communication, such as verbal and nonverbal expression, conversation, what is said and how things are being said (Taubman, Leaf, McEachin & Driscoll, 2017). Social interaction is a reciprocal process that not only involves the conversational aspects of social behavior between individuals, but also includes elements such as initiating play, responding to cues, negotiating decision making, and coping strategies (Shores, 1987; Taubman et al., 2017).

Simon Baron-Cohen and his colleagues have been investigating the mind-blindness theory and autism since the 1980s (Baron-Cohen, 1988). The theory proposed that children with autism are delayed in developing a theory of mind: that is, the ability to reflect on the content of one's own and others' minds (Baron-Cohen, 2001). The studies suggested that children with autism have difficulties in discriminating between appearance and reality, recognizing mental-state words, taking perspectives, monitoring their own and others' intentions, and understanding figurative speech such as metaphors, sarcasm and irony (Baron-Cohen, 2000). However, the authors of the studies also identified some limitations of the mind-blindness theory. First, nonsocial features such as narrow interests and excellent attention to detail cannot be accounted for by the theory. Second, the theory does not analyze why autistic people are puzzled by how to respond to the emotions of other people. Third, mind blindness occurs not only in the autistic population but also in people with other conditions without autism. Fourth, some people with autism do not show the deficits of mind blindness. Moreover, the theory ignores the strengths of autistic individuals (Baron-Cohen, 2009). More recent theories have also argued that even though autistic people often lack understanding about non-autistic people's perception and culture, it is equally true that non-autistic people appear to have difficulties in understanding the minds of autistic people (Crompton et al., 2020a, 2020b; Milton, 2012). Milton (2012) proposed that autistic people often develop a greater understanding of society than non-autistic people, and they have ability to empathize other autistic people. Crompton et al. (2020a) interviewed 12 autistic adults on how they feel during and after spending time together with friends and family. They found that these individuals felt that they were better understood by other autistic people. Another study showed that autistic people can effectively share information with autistic peers (Crompton et al., 2020b).

Some researchers suggested that children with autism have fewer friends compared to typically developing peers (Bauminger & Kasari, 2000). Some autistic children, but not all, feel that the quality of their friendships is poorer than their non-autistic classmates (Calder, Hill & Pellicano, 2013). Sedgewick and colleagues (2016) conducted a mixed method study to examine gender differences in the social motivation and friendship experiences of autistic and non-autistic adolescents. Forty-six adolescents attending special schools in England, including 13 girls with autism, 13 girls without autism, 10 boys with autism and 10 boys without autism, completed a Friendship Qualities Scale (FQS). They also participated in semi-structured interviews to talk about the meanings of friendship, activities with friends, and their satisfaction with their current friendships. The results of the FQS demonstrated that autistic and non-autistic girls showed similar social motivation and friendship quality, while autistic boys reported lower ratings in terms of friendship quality compared to non-autistic boys. The findings were consistent with the results of the semi-structured interviews except that autistic girls in the interviews reported high levels of relational aggression within their friendships. Sedgewick, Hill and Pellicano (2019) conducted another study to examine gender differences in the social relationships of autistic and non-autistic adolescents from mainstream educational settings. The results illustrated the novel finding that autistic girls reported more relational conflict than autistic boys and non-autistic adolescents. Sedgewick et al. concluded that the social experiences of autistic boys and girls are different. Girls are socialized differently from boys. It is important to consider the gender instead of just the diagnostic condition in the social experiences of autistic adolescents.

The social characteristics of autistic individuals may lead to some negative outcomes, including loneliness (Bauminger, Shulman & Agam, 2003), depression (Stewart et al., 2006), and suicidal ideation (Mayes, Gorman, Hillwig-Garcia & Syed, 2013). However, the papers mentioned here do not clearly demonstrate the links between social difficulties and these

outcomes. Hedley and colleagues (2017) examined the inter-relationships between social support, depressive symptoms and suicidal ideation in adults with autism. The results suggested that the links remained unclear.

All in all, autistic people display various social characteristics and difficulties. Gender also plays a role in social development. People with autism need individualized strategies and support to understand their social expectations and to address their social challenges.

Behavioral characteristics. Autistic children are characterized by stereotyped or repetitive motor movements, use of objects or speech; insistence on sameness; fixated interests; and sensory issues (Hong Kong Department of Health, 2017). These characteristics are often referred to as self-stimulatory behaviors by behavioral interventionists. Lovaas, Koegel, Simmons and Long (1973) reported on 20 autistic children who showed a high incidence of self-stimulatory behaviors such as rocking, spinning, twirling, flapping and gazing. The behaviors were described as "[appearing] solely to provide the children with proprioceptive feedback" (p. 133). Leaf and McEachin (1999) suggested that self-stimulation should be targeted for reduction because it interferes with attention, makes adaptive behaviors less appealing, and can be stigmatizing.

However, self-stimulation can be seen from different perspectives. Some autistic adults have reclaimed the stereotyped or repetitive motor movements as 'stimming'. More recent theories have suggested the positive impacts of stimming for autistic individuals. Stimming may provide not only personal entertainment (Leaf & McEachin 1999), but also relief from excessive sensory stimulation and emotional excitation (Leekam, Prior & Uljarevic, 2011), a soothing rhythm to handle distress (Davidson, 2010), and useful coping mechanisms to manage uncertainty and anxiety (Joyce et al., 2017). Kapp et al. (2019) interviewed 32 autistic adults to share their perceptions and experiences of stimming. The results showed that stimming serves as a self-regulatory mechanism, though it is lacking

social acceptance. The participants objected to treatment that aims to eliminate stimming, believing instead that the behavior can gain acceptance through increasing understanding among non-autistic people.

Wolf, Risley and Rees (1963) reported on an autistic child who displayed extreme tantrums, self-destructive behaviors and eating issues. Lovaas (1987) stated that, autistic children show "minimal emotional attachment, absent or abnormal speech, retarded IQ, ritualistic behaviors, aggression and self-injury" (p. 3). Even though some previous research suggested that aggressive behaviors are more common among children with autism than in other populations (Farmer & Aman, 2011; Mayes et al., 2012), the prevalence estimates of these behaviors vary widely, possibly due to differences in the definitions of aggressive behaviors, the measures used, and the sampling methods. Farmer and Aman (2011) compared a sample of 121 children with autism to 244 children with other intellectual and developmental disabilities. Results showed that some (not all) types of aggressive behaviors such as bullying and hostility were more common in children with autism than other groups. Mayes et al. (2012) studied a sample of 1609 children with different diagnoses including high functioning autism, low functioning autism, typical children, and other clinical disorders such as anxiety disorders, depression, and acquired brain injury. The results varied across behaviors and groups. The findings were overall similar for some behaviors such as explosiveness, opposition and aggression.

My experience and that of others (Freeman, 1997; Leaf & McEachin, 1999; Leaf et al., 2015) suggests that there is considerable behavioral heterogeneity among children with autism. The presence of extreme behaviors was observed in a small sample (Lovaas et al., 1973; Lovaas, 1987; Wolf et al., 1963). The children selected for the Lovaas et al. (1973) study had more than one diagnoses on top of autism, and were referred to as "retarded" and "brain damaged". These terms are not generally used today because they are considered

stigmatizing. It is important to note that these highly aggressive behaviors reflect a form of autism associated with higher support needs and greater impairments, especially communication difficulties. They do not represent the whole autistic population. In my clinical observation, some individuals on the spectrum are relatively passive and quiet while others may engage in obvious challenging behaviors such as aggression and temper tantrums. The challenging behaviors observed in some autistic children definitely need to be addressed because these behaviors affect children's well-being and interfere with their learning and socialization. Since autistic individuals' needs and difficulties in learning in a natural environment are different, some require more substantial support than others (Leaf et al., 2015). Individuals at different ages require varying attention in terms of curriculum focus, with different emphases on behavior management, play and leisure, as well as motor, language, social, cognitive, academic, self-help, community, and vocational skills (Leaf & McEachin, 1999).

Chapter Three: Applied Behavior Analysis

There are different behavioral treatments and interventions available for individuals with autism, including Applied Behavior Analysis (ABA), Occupational Therapy and Speech Therapy (Anderson et al., 2017). The most empirically supported and commonly used interventions for people with autism are models based on ABA principles (Reichow, 2012), such as Early Intensive Behavior Intervention, which is based on the Lovaas UCLA Young Autism Project model (Lovaas, 1987). At the same time, ABA is a controversial intervention because some literature suggests that there is inadequate evidence to show that ABA achieves a better outcome than standard care (Spreckley & Boyd, 2009). It has been argued that ABA is not effective in changing the symptoms of autism (U.S. Department of Defense, 2019), and that it does not address the subjective feelings and mental processes of autistic individuals. This chapter will discuss the definitions of ABA, research supporting ABA's effectiveness, research against the effectiveness of ABA, and critiques of ABA.

Definitions of ABA

The cognitive approach to understanding people with autism can be introspective, which means that it engages with the subjective feelings and mental processes of each autistic individual. In contrast, behaviorism takes an objective approach, seeing human beings as the result of interactions with the external environment (Gudmundsson, 2018). Behaviorism was formally established by John B. Watson, who published his paper “Psychology as the Behaviorist Views It” in 1913. Watson believed that all behaviors are the result of experience. Behaviors can be learned and unlearnt through the manipulation of the environment (Watson, 1913). Behaviorism excludes the cognitive and neural levels of analysis (Watson, 1970). Applied Behavior Analysis (ABA) follows the principles and theories of behaviorism emerging from the work of B. F. Skinner, who suggested that behavior is determined through a process called “selection by consequence” (Skinner, 1981).

ABA is defined as “a science devoted to the understanding and improvement of human behaviors” (Cooper, Heron & Heward, 2014 p. 23). Leaf et al. (2016) claimed that ABA is a science that involves progressive approaches and outcome. As a science, ABA involves experiments that are conducted systematically to identify variables responsible for behavior changes. Researchers have used scientific methods to show that children with autism make meaningful improvements in terms of behaviors, language, play, self-help, social skills, and communication skills through intensive ABA-based intervention (Eldevik et al. 2019; Howard et al., 2005; Sallows & Graupner, 2005). ABA interventionists change behaviors through different strategies such as reinforcement, shaping, prompting, task analysis, functional analysis and systematic manipulation of the physical environment. Some interventionists claimed that children with autism can become indistinguishable from their non-autistic peers (Lovaas, 1987; McEachin et al., 1993). Baer, Wolf and Risley (1968) identified seven characteristics of ABA: applied, behavioral, analytic, technological, conceptually systematic, effective, and generality.

Applied. ABA focuses on improving behaviors that enhance people’s quality and standard of living.

Behavioral. The behavior that needs to change should be measurable.

Analytic. A functional relation between the target behavior and the intervention is reliably demonstrated.

Technological. Procedures are clearly defined so that any trained person can perform the program consistently.

Conceptually systematic. The intervention should base on past research.

Effective. The intervention should be effective enough to change behavior to a practical degree.

Generality. Behavior change lasts over time, appears across other environments, and spreads to other behaviors that were not directly targeted.

Many studies support intensive ABA as an effective intervention for symptoms of autism (Eldevik et al., 2019; Howard et al., 2005; Leaf et al., 2011; Lovaas, 1987; McEachin, Smith & Lovaas, 1993; Myers & Johnson, 2007; Roane, Fisher & Carr, 2016; Sallows & Graupner, 2005). Later in this chapter, more information about these studies supporting the effectiveness of ABA for children with autism will be provided and discussed. In this section, an in-depth discussion of the pioneer study by Lovaas (1987) will be presented for two reasons. First, it was groundbreaking at the time, and perhaps crucial for understanding contemporary ABA approaches. Second, my professional work has been greatly influenced by the Lovaas approach. My supervisors in the Autism Partnership, Dr. Ronald Leaf and Dr. John McEachin, were the key members of the Lovaas' Young Autism Project.

UCLA Young Autism Project

Professor Ivar Lovaas from the University of California Los Angeles (UCLA) first documented ABA as an effective intervention for children with autism in his article "Behavioral Treatment and Normal Educational and Intellectual Functioning in Young Autistic Children" (Lovaas, 1987). The article described the Young Autism Project (YAP) and reported that 47% of participants achieved normal intellectual and educational functioning after receiving prolonged intensive ABA-based intervention at an early age. Five years later, a follow-up study indicated that eight out of the nine students who achieved the 'best outcomes' maintained positive results on intelligence and adaptive behaviors (McEachin, Smith & Lovaas, 1993). These results were replicated in a later study, which found that 47% of participants were succeeding in regular education classrooms (Sallows & Graupner, 2005). The treatment outcome was consistent with those reported by Lovaas and colleagues. Between 1987 and 2009, Lovaas's (1987) study was replicated with similar

findings by at least other 11 researchers (e.g., Anderson, et al., 1987; Cohen et al., 2006; Harris & Handleman, 2000; Smith, Buch & Gamby, 2000; Sallows & Graupner, 2005).

The Lovaas study investigated an early intensive behavioral intervention project which aimed to maximize the benefits of behavioral treatment by teaching children with autism most of their time for two to three years. In the study, 19 out of a total of 38 children were assigned to receive an average of 40 hours a week of ABA therapy as an 'intensive treatment' experimental group. The other 19 children were assigned to the 'minimal treatment' group, and received a maximum of 10 hours a week of ABA therapy. Besides those 38 children, another control group of 19 children did not receive any ABA therapy. Treatment lasted for at least two years. The researcher used a group-comparison quasi-experiment design to measure the children's performance before and after the intervention to demonstrate therapy outcomes. Therapy outcome was defined by Intelligence Quotient (IQ), school placement, and diagnosis. The children achieved the 'best outcome' by having an average IQ score, attending regular school independently, and with an indistinguishable diagnosis results from peers without autism. The children obtained a 'Fair outcome' by having an IQ score within the 'mildly retarded' range, attending a school for special needs aside from an autism school, and diagnosis results as non-autistic. The children got a 'Poor outcome' when their IQ score was remained in a 'profoundly retarded' range, attending a school specialized for autism, and a continuing diagnosis of autism. For the experimental group, nine children attained the 'best outcome', eight reached the 'fair outcome', and two got the 'poor outcome'. In the minimal treatment group, no students achieved the 'best outcome', 10 achieved the 'fair outcome', and nine achieved the 'poor outcome'. In the control group, one student achieved the 'best outcome', 10 students achieved the 'fair outcome', and eight students achieved the 'poor outcome'. The results suggested that a more

intensive early behavioral intervention helps most of the children with autism make more overall progress.

McEachin, Smith and Lovaas (1993) followed up the Lovaas (1987) study's findings by assessing the participants from the first study at a mean age of 13.5 years. Results showed that students from the intensive treatment experimental group preserved their gains over the control group. Extensive evaluations indicated that eight of the nine children who achieved the best outcome in 1987 were indistinguishable from non-autistic children on intelligence and adaptive behavior tests. The authors concluded that behavioral treatment might produce long-lasting and significant gains for many young children with autism.

Lovaas (1987) presented an experiment with a clear hypothesis, methods, findings, possible limitations, and discussion. There are some positive notes of the study. As a practitioner for autism who has been teaching students with autism and educating behavioral therapists for over 20 years in 10 countries, I believe that the most appropriate research paradigm in demonstrating effective intervention and outcomes is scientific research. The Lovaas study provided me with some useful knowledge about autism and the treatment approach. The author described the target skills and behaviors. The study clearly showed that intensive early behavioral intervention effectively helps students with autism gain more overall progress.

On the other hand, Lovaas identified some limitations of the original ABA study (Lovaas, 1987). First, replication of the intervention is difficult because the study did not describe and explain the treatment techniques and strategies in detail. Second, IQ, speech and play skills are not easily measured, especially for students with autism because they may not perform well in tests because of a lack of motivation and responsiveness, as well as interfering behaviors. Third, there was inter-subject variability due to different students have varied functioning levels and needs. Fourth, some variables responsible for treatment

outcomes were not identified. Other variables may affect intervention outcomes, such as the influence of peers. Fifth, the term ‘normal functioning’ has an ambiguous definition. Last, the study did not adopt a strict random sample assignment. The students were assigned to different groups based on availability of the behavioral therapists and the families’ place of residence.

There are some other weaknesses on top of the limitations described by the author. The study did not explain why the intervention is effective for some students but not for others. It is also difficult for other practitioners to apply the intervention for their clients because the author did not describe the stages of the intervention, settings, and therapeutic procedures. Furthermore, the study did not report how the therapists collaborated with the parents and the level of parent involvement. Hence, the positive results may not be generalized across individuals and settings because of incomplete information, varied functioning levels of children, and the changing diagnostic criteria of autism. In addition, the number of participants is small in the study. It is uncertain if the results are relevant to other children with autism, as it is difficult to generalize from small samples. In Lovaas’s study, the researchers targeted observable operant behaviors including imitation skill, play and leisure skills, speech development, independence. However, the study did not address any of the children's emotional responses. It did not mention any teaching objectives to address the children's feelings, thoughts, and analytical skills. Williams (2018), who describes herself as “autonomously autistic” (p. 60), criticized Lovaas’s study based on the root assumption of behaviorism; that is, “the mechanistic view of human behavior as an observable and predictable collection of stimuli-response bonds” (p. 69). William argued that Lovaas “viewed the presence of autistic traits as the absence of personhood”. Furthermore, Williams criticized Lovaas’s study for the use of aversive punishment procedures such hitting and spanking the child upon the occurrence of self-injurious behaviors as “benevolent cruelty” (p.

69). Indeed, it is unquestionable that the use of physical punishment to decrease self-injurious behaviors and self-stimulation of the children in the experimental group is unethical and inhumane. The use of strong aversive punishment can lead to long-term psychological consequences for children, such as depressive and anxiety symptoms (Miu et al., 2017) and even post-traumatic stress symptoms (Kupferstein, 2018). Also, physical punishment when applied by parents may decrease the quality of the relationship between a child and their parents, as well as increasing the risk of parental physical abuse (Gershoff, 2002).

A final weakness of Lovaas's study is that the parents who participated in the study may have felt very stressed as they were arranged to receive training to become total experts in doing behavioral therapy. They were suggested to take up the role of being the therapists instead of being their child's parents. Hobbs (1995) examined the economic and psychological burden of 22 parents associated with the use of the Lovaas treatment approach with their autistic child. The results showed that more than 90% of the respondents perceived high levels of stress. It was suggested that the fathers often felt stressed because they did not see their child making progress, while the mothers felt stressed because they felt more responsible for the care and program of their children.

Literature Supporting ABA's Effectiveness

The American Academy of Pediatrics described the benefits of ABA for children with autism in the United States. Myers and Johnson (2007) reviewed six educational strategies and treatments for children with autism. The authors explained that children with autism who received ABA demonstrated "substantial, sustained gains in IQ, language, academic performance, adaptive behavior, and some measures of social behaviors" (p. 1164). An article from the *Journal of Pediatrics* stated that ABA has shown some benefits in some children with autism, such as encouraging the development of language and play skills while decreasing challenging behaviors. The editors concluded that children with autism should

receive 10-25 hours a week of ABA, and pediatricians should be knowledgeable with the basic principles and applications of ABA (Roane et al., 2016). However, the evidence supporting ABA presented in this article comes primarily from small-sample studies that used a within-subject experimental design rather than randomized clinical trials (RCTs). As such, the strength of the evidence regarding the effectiveness of ABA treatment is subject to disagreement or doubt.

Some government organizations support ABA for autistic children. As far back as 1999, the Surgeon General of the United States declared that thirty years of research demonstrated ABA has effectively reduced inappropriate behavior and increased communication, learning, and appropriate social behavior for children with autism (Satcher, 2000). A widely cited book, *Educating Children with Autism*, concluded that ABA was the treatment most supported by research and most effective for autism (National Research Council, 2001). The review stated, “Forty years of single-subject-design research testifies to the efficacy of time-limited, focused applied behavior analysis methods in reducing or eliminating specific problem behaviors and teaching new skills to children and adults with autism or other developmental disorders” (p. 120). The Ministry of Health Singapore recognized early intensive behavioral intervention as the gold standard for the therapy of autism (Academy of Medicine Singapore-Ministry of Health Clinical Practice Guidelines Workgroup on Autism Spectrum Disorders, 2010). The New York State Department of Health updated their guidelines for autism treatment, recommending that *“*... the principles of ABA be included as an important element of any intervention program for young children with autism” (Anderson et al., 2017, p. 59). However, it should be noted that the report reviewed studies mostly using single-subject-design research. This design has a limited evidence base because of concerns regarding external validity, internal validity, and data analysis via visual inspection.

Outcome studies have shown the effectiveness of intensive ABA for children with autism. Sallows and Graupner (2005) randomly assigned 23 children with autism (aged at intake between 24 and 42 months) to a clinic-directed group and a parent-directed group for intensive ABA intervention based on the UCLA Lovaas model without aversive punishment. In the clinic-directed group, 13 children received about 40 hours a week of direct treatment provided by trained therapists for four years. The 10 children from the parent-directed group received an equal amount of treatment with the same intensity and duration, implemented by parents who were supervised by workshop consultants. The results showed that 48% of all children demonstrated rapid learning, achieved population average scores on outcome measures, and succeeded in regular education classrooms. It should be highlighted that the ABA intervention in the study did not use any aversive punishments to produce this positive outcome. However, the research employed a small number of children. The study also has limited statistical power in detecting a difference between the clinic-based treatment and the parent-managed intervention package.

Howard et al. (2005) used quantitative methods to compare the treatment outcome for 61 children with autism between intensive ABA-only treatment, intensive multi-treatment, and low intensive multi-treatment. The authors hypothesized that not only would treatment intensity affect the outcome, but also the type of intervention would have a significant impact on treatment outcome. The results of the 14-month study showed that children in the intensive ABA-only group achieved more progress in almost all areas than the other two groups. Areas with more gains in the ABA-only group included non-verbal skills, receptive and expressive language, communication, social skills, and self-help skills. The gains in motor skills were similar between the ABA-only group and the intensive multi-treatment group. Several limitations to this study should be pointed out that constrain the interpretation that intensive ABA-only treatment achieved a better outcome than the intensive multi-

treatment package and low intensity multi-treatment intervention. First, treatment groups were not assigned on a random basis. Second, the examiners who assessed the outcome could be biased toward the intensive ABA-only group because they were aware of the children's group assignment. Third, the outcome was assessed in a formal testing situation using a standardized, norm referenced assessment instead of repeated direct observational measurement of behavior. Last, treatment integrity, that is the extent to which treatment was implemented as intended, was not measured in the study.

Leaf et al. (2011) reported the outcome of an ABA-based program for individuals with autism provided by an international community-based agency, Autism Partnership (AP). The founders of AP and many lead staff received training under Dr. Ivar Lovaas at UCLA and served as co-directors of treatment and research as part of the UCLA Young Autism Project. The report retrospectively reviewed 64 children with autism from four AP offices. The children received an average of 21.7 hours a week of treatment for about three years. The results demonstrated that the IQ scores of 45 out of 64 children increased an average of 22.5 points. However, there are some conceptual and methodological concerns with the use of IQ scores as outcome criteria. For example, Beaujean and Farmer (2020) pointed out that administering the same intelligence instrument repeatedly within a short time period can increase scores due to practice effects. Moreover, it should be emphasized that the study is a retrospective report—data was collected based on the availability of post-treatment assessment reports. The strength of the evidence is considered weak compared to studies using experimental, controlled analyses.

Eldevik, Titlestad, Aarlie and Tonnesen (2020) evaluated the outcome of different intensive interventions based on ABA principles for 74 children with autism in Norway. A group of 21 children received 11 hours a week of low-intensive intervention. The second group of 26 children received 18 hours a week of higher-intensity intervention. The third

group of 17 children received an eclectic combination of different methods and approaches that included ABA, Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH), total communication, and sensory-motor therapies. After one year of intervention, the results showed that higher intensive ABA-based intervention produced better outcomes in terms of adaptive behavior, intellectual functioning, and autism severity. However, the results should be viewed with caution because the authors of the study state that they are missing some important data, including autism severity data from the eclectic group as well as data on intellectual functioning in the high intensity behavioral intervention group. It is possible that the outcome between groups is related to the different functioning level of the children instead of the intensity of treatment.

Some researchers conducted literature reviews and meta-analyses to support the effectiveness of ABA for individuals with autism (Eikeseth, 2008; Reichow & Wolery, 2009; Rogers & Vismara, 2008; Virués-Ortega, 2010; Wong et al. 2015). These are described below.

Rogers and Vismara (2008) reviewed five studies using randomized controlled designs, eight studies using nonrandomized controlled deigns based on the Lovaas treatment model, and two controlled studies of other approaches. The review implied that ABA had been generally proven to provide significant gains to individuals with autism. However, given the few RCT studies available, the small number of studies being reviewed, and the large difference in interventions that are published, it is difficult to determine which interventions are most effective for autism.

Eikeseth (2009) evaluated 25 outcome studies on early intervention for children with autism. The results showed that ABA effectively enhances global functioning in preschool children with autism when the treatment is intensive and implemented by trained therapists. It should be pointed out that this review included only studies that meet the definition of

comprehensive interventions. Furthermore, the identified studies were evaluated by reviewing the gains in ratio or deviation scores based on IQ and adaptive functioning.

Reichow & Wolery (2009) published a comprehensive synthesis of interventions based on the UCLA Young Autism Project. The authors included 13 research reports in the review. The results suggested that early behavioral interventions were on average an effective treatment for children with autism. However, the authors advised that the results should be interpreted with caution due to gaps and limitations in the evidence base such as nonrandom assignment, lack of details of comparison group interventions, and failure to measure procedure fidelity across participants, therapists, and conditions.

Virués-Ortega (2010) used meta-analytical methods to measure the effectiveness of an ABA intervention for young children with autism. The results showed that ABA has affected the children's development positively on many aspects, including intellectual functioning, language, social, and self-help skills. Again, the studies found in this review mostly did not use randomization in group assignment. General quality standards of clinical studies including blindness, intention to treat analysis, and prospective designs were inconsistently observed.

Wong et al. (2015) found 27 focused intervention practices out of 456 studies published from 1990-2011 that met the criteria for evidence-based practice for children with autism. These practices mainly consist of therapy strategies, assessment, and analytical techniques based on ABA principles, such as reinforcement, discrete trial teaching, shaping, prompting, task analysis, functional behavior assessment, and using a picture exchange communication system. It should be noted that the review only investigated the practices that were efficacious. It did not include the practices that researchers reported as not effective or having deleterious effects.

All in all, researchers have repeatedly shown that when children with autism receive ABA-based intervention they demonstrate gains in IQ, language, academic performance, adaptive behaviors and some social behaviors. However, the outcomes of ABA treatment for autistic children were mixed, and general quality standards of clinical studies were inconsistently observed.

Literature Against ABA's Effectiveness

ABA has long been criticized as robotic and unnatural. An article from *Time Magazine* commented that children learn mechanical responses from ABA treatment, they lack emotion, and they cannot perform the skills outside clinical settings (Wallis, 2006). Some research has suggested that the evidence to support ABA's effectiveness for individuals with autism is limited (Howlin, Magiati & Charman, 2009; Warren et al., 2011). Some studies even present evidence that ABA is not effective for individuals with autism (Spreckley & Boyd 2009; U.S. Department of Defense, 2019). This section will discuss the literature against ABA's effectiveness in detail.

Howlin, Magiati and Charman (2009) conducted a systematic review of controlled studies of early intensive behavioral interventions (EIBI) for young children with autism. The authors initially identified 641 studies, which they then narrowed down to 11 papers that met the inclusion criteria: that they presented a case-control comparison study, had a minimum of 10 participants, and had adequate data on IQ or other standard measures. The results showed that ABA was effective for some, but not all, preschool children with autism. Out of the 11 reports, two indicated no difference between the EIBI and comparison groups on verbal and nonverbal IQ improvement. Some children who received EIBI achieved educational independence, defined as coping without support in a mainstream school, but some remained in special educational settings. Even though the majority of children from the EIBI group demonstrated positive changes, some failed to make improvement despite thousands of

therapy hours of treatment (Lovaas, 1987). The variability in EIBI outcome could be associated with the use of different assessment methods, the initial language level and IQ of the children before intervention, and the level of behavior problems and autism symptoms at intake.

Spreckley and Boyd (2009) reviewed the effectiveness of ABA programs for the cognitive, adaptive behavior, and language development of preschool children with autism. The researchers evaluated 13 studies, including six randomized comparison trials with adequate methodological quality and four meta-analyses that compared ABA with standard care such as TEACCH, total communication, and sensory-motor therapies. The results showed that ABA interventions did not notably improve children's cognitive outcomes in the experimental group. There was no additional benefit for receptive and expressive language, and adaptive behaviors over standard care. The authors suggested that ABA requires appropriately powered clinical trials with a broader outcome to support its effectiveness for children with autism.

Another comprehensive review of the literature on ABA-based interventions for autism conducted by the Agency for Healthcare Research and Quality concluded that the strength of evidence for their effectiveness is low (Warren et al., 2011). The investigators located 38 papers comprising 34 studies addressing EIBI. The relevant population of the identified studies were children aged 2-12 with autism or aged 0-2 at risk for diagnosis of autism. The papers being reviewed used different study designs, including RCTs, nonrandomized controlled trials, prospective and retrospective cohort studies, case-control studies, and case series. Other inclusion criteria specified that the papers must present original research studies with sufficient details about methods and results; have relevant populations and 10 or more participants with autism; and address treatment outcome for children with autism. Even though the results indicated that most children demonstrated a

meaningful improvement in specific areas such as cognitive skills, long term outcome data is still very limited, and they often continued to have substantial impairments in adaptive, social, and behavioral functioning. Moreover, most studies showed that not all children receiving early ABA-based intervention demonstrate robust gains. The authors also suggested that there have been a very few well-controlled trial studies, and most research studies have used small samples, children of varying ages, different intervention approaches with varying duration and intensity, varied inclusion and baseline assessment criteria, and different outcome measurements over different periods of time. As a result, the strength of the evidence for the efficacy of early intensive ABA-based intervention is low, and the potential benefits of the intervention should continue to be studied. There is a need for more long-term outcome studies, and more rigorous research methods such as RCTs should be employed to enhance the research's strength of evidence.

In 2019, the U.S. Department of Defense reported that ABA was not effective for individuals with autism. The study reviewed the Pervasive Developmental Disabilities Behavior Inventory (PDDBI) score of 709 individuals with autism who had received 12 months of ABA services. The concerning result showed that 76 percent of the participants reported no symptom improvement, with an additional nine percent demonstrating worsening symptoms (U.S. Department of Defense, 2019). However, the findings of this most recent review should be interpreted with caution because the study relied only on written documents and reports available in 'The Department of Defense Comprehensive Autism Care Demonstration' program. The review did not consider and include any information regarding age, symptom severity, intensity of ABA services, other services used, and academic placement.

Many studies support the use of ABA for individuals with autism. However, the effectiveness of ABA for individuals with autism is questionable to many researchers, as

most available studies did not use appropriately powered clinical trials and study methods, evidence for a long-term positive outcome is limited, and some children receiving early intensive ABA-based intervention did not make robust gains.

Critiques of ABA

Alongside questions about the effectiveness of ABA, there are critiques that ABA affects autistic individuals negatively and should be abandoned (Autistic Self Advocacy Network, 2015; Kapp et al., 2019; Kupferstein, 2018, 2019; Williams, 2018).

Kupferstein (2018) found that children and adults with autism exposed to ABA had increased chances of suffering from posttraumatic stress symptoms (PTSS). The author collected data from 460 respondents through online questionnaires. The results showed that 46 percent of the ABA-exposed respondents met the diagnostic threshold for posttraumatic stress disorder (PTSD), and ABA-exposed respondents were 86 percent more likely to meet the PTSD criteria than non-ABA-exposed respondents. Also, the survey found that adults with ABA exposure had low satisfaction with ABA.

The author followed up with a secondary analysis of the primary data set using a mixed-method thematic analysis to review the long-term impact of ABA. The results showed that individuals with autism who received no intervention had a 59 percent lower likelihood of meeting the PTSD criteria compared to peers who had undergone ABA intervention. Within the 23% of respondents who selected eclectic approaches such as psychotherapy, mental-health focused interventions, 63% were asymptomatic. Some people with autism and their caregivers discontinued ABA because they observed trauma symptoms associated with ABA (Kupferstein, 2019).

Leaf, Ross, Cihon and Weiss (2018) criticized Kupferstein’s claims regarding the relationship between behavioral intervention and PTSS for individuals with autism. The researchers evaluated Kupferstein’s methodological rigor on the use of hypothesis testing,

indirect measures, respondent selection, ambiguity in ABA-based interventions described, and the measurement system. The authors concluded that due to numerous methodological flaws, no confirmation of diagnosis, incomplete description of interventions, and use of leading questions in the survey, Kupferstein's results should be viewed with caution.

Autistic adults have voiced their criticisms of ABA (Autistic Self Advocacy Network, 2015; Kapp et al., 2019; Williams, 2018). The Autistic Self Advocacy Network, a nonprofit organization run by and for autistic people, argue that the evidence base for ABA is relatively weak. Self-advocates and families have raised their concerns about ABA's unethical practices, such as the use of physical punishment and electric shocks on individuals with autism (Autistic Self Advocacy Network, 2015). Slapping the thigh of a child with autism upon the occurrence of excessive self-stimulatory behavior and self-injury was one of the standard intervention procedures in Lovaas's Young Autism Project. Nowadays, any form of physical punishment is forbidden in ABA interventions. Sadly, there are still some incidental instances where such unethical practices have been applied. Anna Williams, an autistic Ph.D. candidate, published an article questioning the efficacy of early intensive behavioral intervention based on ABA principles. She strongly criticized Lovaas, saying that he "chose to manipulate the environment to his own ends - extinguishing our autistic expression, building compliance through coercion - rather than respecting the self-determination of the children in his care" (Williams, 2018, p. 74). Williams thus argued that Lovaas prioritized behavioral changes and treatment progress over students' autonomy and dignity. Kapp et al. (2019) interviewed 32 autistic adults and invited them to share their views of stimming (self-stimulation). The results of the thematic analysis identified that stimming is a self-regulatory mechanism, lacking in social acceptance. Autistic adults emphasized that stimming serves as an adaptive mechanism that helps them to soothe themselves, and as a means to communicate their intense emotions or thoughts. As such, they objected to an intervention that aims to

eliminate these behaviors instead of teaching autistic people to learn other replacement behaviors that could serve the function of an adaptive mechanism.

Conclusion

The identified papers that either support or critique ABA each have their strengths and limitations. The studies should be viewed critically. The effectiveness of ABA for individuals with autism is affected by several factors, including early intervention (Lovaas, 1987; McEachin et al., 1993; Sallows & Graupner, 2005), intensity (Eldevik et al., 2019; Howard et al., 2005; Roane et al., 2016), consistency (Eldevik et al., 2019; Howard et al., 2005; Leaf et al., 2011), parental involvement (Lovaas 1987; Sallows & Graupner, 2005) and the student's cognitive ability, as individuals with autism have different learning capacities, strengths, and weaknesses. As a Board Certified Behavior Analyst (BCBA) with over 20 years of experience in applying ABA-based intervention for individuals with autism and educating ABA therapists, I have learned that not all ABA is alike. The quality of service is also a factor that affects the treatment outcome. Some ABA programs are very rigid, taking an extremely protocol-driven approach that reinforces mechanic and robotic responses. Some ABA programs are very loose, with almost no plan and structure, which can leave students very confused. Leaf et al. (2015) suggested that a quality ABA-based intervention for individuals with autism takes a structured yet flexible and responsive approach, using continuous in-the-moment analysis. The authors claimed that “ABA is a science and, therefore, progressive”. The components of a comprehensive, flexible and progressive ABA approach include not just one procedure, but a variety of different instructional formats ranging from one-on-one work to classroom group settings, in-the-moment reinforcer analysis, using knowledge of the function of aberrant behaviors, natural discrete trial teaching, taking just enough data, focusing on meaningful programs, designing an all-

inclusive curriculum, and ongoing dynamic staff training addressing both theoretical and practical skills.

Chapter Four: Study Setting: Aoi Pui School

In Hong Kong, young pupils with autism receive special training and care provided by the Social Welfare Department. The support is usually offered by social workers, speech therapists, occupational therapists, social worker and school teachers for pupils with special education needs. For pupils with autism aged six or above, the government provides integrated education and special school placement based on the individual's Intelligence Quotient (IQ). ABA is an evidence-based practice, and one of the main strategies for treating pupils with autism enacted explicitly by the Hong Kong Government (Hong Kong Department of Health; Hong Kong Education Bureau, 2007). However, no ABA school for pupils with autism was available in Hong Kong until the establishment of Aoi Pui School (APS) in 2007 (Au et al., 2015). This study examines progressive ABA, the benefits and issues of using screen-based media among pupils with autism, and how teachers manage technology use and related problems in APS. This chapter will describe the purpose of APS and its history, along with general school information, characteristics, and challenges.

Purpose of the School

Aoi Pui School was initially named 'Autism Partnership School'. The school was founded in 2007 in Hong Kong, one of the world's most cosmopolitan cities, located in South East Asia. Au et al. (2015) explained that the school was created because some parents who had their children receive early ABA-based intervention failed to find a primary school placement that would meet their different expectations. Namely, they struggled to find a placement that provided behavioral education to their child of the same quality they were accustomed to, that implemented group instruction with their child, and that continued to maximize the child's potential. According to "Aoi Pui School" (2020), the philosophy of the school is to provide education for pupils with autism: (a) based on ABA principles; (b) with an individualized and effective curriculum that builds upon their strengths and works on their

deficits; (c) to enhance their quality of life now and in the future with the provision of opportunity and resources; and (d) to provide professional training and education to parents, caregivers, teachers, and other related professionals.

History

Founding of the school. Aoi Pui School is located in the Hong Kong Special Administrative Region (HKSAR) of the People's Republic of China. Until 1997, Hong Kong was a colony of the British Empire in which most residents spoke Cantonese and English. However, there was no English-speaking school for pupils with autism. Typically, educational placement for primary-school-age pupils with autism is allocated according to their intellectual abilities. Pupils with an IQ below 70 are placed in special schools. Pupils with IQ scores of 70 or above are placed in ordinary schools with typically developing pupils (Hong Kong Education Bureau, 2014). Nevertheless, until APS was founded there was no school specializing in supporting pupils with autism. Several prominent parents in Hong Kong realized the need for a school to provide more tailor-made education for primary-school-age pupils with autism. Therefore, APS was founded as the very first autism school in Hong Kong to provide education to a wide range of pupils with autism of different languages and intellectual capacities (Au et al., 2015).

Founders of the school. APS was founded by the directors of Autism Partnership (AP), Dr. Ronald Leaf, Dr. John McEachin, and Mr. Toby Mountjoy. AP was established in 1994 in the United States. It is an international community-based agency that provides intensive ABA-based intervention to children and adolescents diagnosed with autism (Leaf et al., 2011). Dr. Leaf, Dr. McEachin, and some key members at the agency learned autism treatment from Dr. Ivar Lovaas at UCLA in the 1970s. Many served as Dr. Lovaas' students, as clinic directors, co-principal investigators, and co-directors of the pioneering research associated with the UCLA Young Autism Project. The treatment strategies adopted by AP

have been modified and have evolved from the original UCLA model, including an increased focus on parent education, increased collaboration with schools, and emphasis on the use of proactive procedures to manage challenging behaviors. It also includes more comprehensive programming to encourage the development of skills in observational learning, advanced language, social interaction, play, self-help, and daily living (Leaf et al., 2011). The most recent evolution consists of other advancements. First, there is more focus on building strong learning foundations such as compliance, meaningful attending, effort, and persistence. Second, there is an emphasis on developing naturally occurring reinforcers to promote behavior and skill transfer to the real world. Third, the model aims to help pupils to learn in small and large groups. Fourth, therapy is conducted in natural settings so that it is not necessary to remove distractions or use artificial instructions. Fifth, pupils are assisted in becoming truly independent. Last, counseling services are provided for children, sibling, and parents (Leaf, Leaf & McEachin, 2018).

General Information

Funding of the school. The Hong Kong government states that they "encourage students with special educational needs to receive education in ordinary schools as far as possible, or in special schools when necessary" (Hong Kong Education Bureau, 2020). There is no government funding for schools that are considered non-inclusive of pupils with average IQs. Thus, APS is a self-funded school with the majority of the costs paid by the parents. The fee structure of the program per pupils is $25,500 Hong Kong dollars (approximately $3270 US dollars) per month (Aoi Pui School, 2020).

Service provided by the school. APS adopts Applied Behavior Analysis (ABA) as a primary principle for teaching. The school caters to Cantonese and English-speaking children aged from five years and six months old to fifteen years old. All the classes are of small size with a high teacher-student ratio of 1:3. APS provides full-day classes with only two weeks

of summer holiday (Aoi Pui School, 2020). Furthermore, the school teachers conduct after-school one-to-one teaching and home visits for different purposes such as skill generalization, parent education, and to provide ideas on how to better structure pupils' free time. Furthermore, APS also collaborates with the local Education Bureau to provide in-service training for local teachers, as currently it is not uncommon for many local school teachers to have to teach pupils with autism in an ordinary school.

Set up and pupils. APS is located in a convenient residential area with a variety of community facilities in the vicinity including parks, shopping malls, restaurants, a theatre, a library, a post office, and a temple. The area is easily accessed by train, bus, and mini-bus. The school premise is a five-story building with a playground and a canteen area on the ground floor. The school itself has a total of eight classrooms; five classes use English as the primary teaching language, and three classes use Cantonese. Each classroom is set up similarly to a typical general education classroom. Approximately 60 pupils attended APS in the 2019-2020 school year. All the pupils had a primary diagnosis of autism. In the years 2013-2019, 50% of pupils who left APS transferred to a regular school successfully (Aoi Pui School, 2020).

Characteristics

Teacher recruitment and training. APS follows a highly selective recruitment process. All teaching staff have to undergo 160 hours of induction training of ABA and receive over 450 hours of supervision in their first year (Aoi Pui School, 2020). Au et al. (2011) described the four broad domains covered in training. The first domain includes teaching techniques such as discrete trial teaching, shaping, prompting, task analysis, group instructions, and teaching interaction procedure. The second domain includes behavior management techniques such as differential reinforcement, functional analysis, reactive, and proactive strategies. The third domain includes curriculum development including language,

play and social skills, pre-academics, academics, and self-help skills. The final domain includes professionalism such as communication skills and ethics. On top of the induction training and weekly supervision, there are monthly staff training sessions, and two to three lectures provided by international consultants. Throughout the training, trainees are evaluated based on their performance and attitudes. Staff employment may be terminated if they display repeated issues in performing their duties, unsatisfactory levels of teaching, a lack of professionalism towards co-workers and clients, and a negative work attitude.

Curriculum. APS adopts the UK National Curriculum approved by the Education Department (Aoi Pui School, 2020). There are four main domains covered in the APS curriculum. The first domain covers language and communication such as spontaneous requests, vocabulary building, understanding questions, comprehension, reasoning skills, and conversation. The second includes play and leisure skills such as cause and effect play, pretend play, sports, generating ideas, group games, and computer games. The third encompasses social skills such as social tolerance, developing social interests, joint attention, initiating play, flexibility, perspective taking, social problem solving, and expressing emotions. The fourth domain covers academic subjects such as Chinese, English, Mathematics, Physical Exercise, Integrated Science, Arts, and Information Technology. The teachers use ABA-based strategies to teach the curriculum. For example, breaking a skill into smaller teaching units; teaching one sub-skill at a time until mastery; asking student to demonstrate the sub-skill, practicing the target skill repeatedly; providing prompt and prompt fading as necessary; using reinforcement procedure such as token economies. To develop a functional and individually focused curriculum, all pupils receive a curriculum assessment adapted from “A Work in Progress Curriculum Assessment” (AWIP) developed by Leaf and McEachin (1999). Additional information about the self-help skills and community skills of each student is collected through home visits and interviews with parents (Au et al., 2015).

Teaching strategies. APS uses research-based strategies based on ABA's theory and principles with a high degree of flexibility in a natural manner (Aoi Pui School, 2020). Many strategies are also commonly deployed by Hong Kong schools for pupils with autism. For instance, creating a structured learning environment by establishing clear classroom conventions and schedule; using visual strategies; providing peer support; teaching the use of speech and communication to express pupils' needs; training social skills and emotional regulation; setting clear behavioral goals and reinforce the behaviors through feedback and rewards (Hong Kong Education Bureau, 2015). However, the school does not endorse or utilize an "eclectic" approach (Au et al., 2015). Eclectic treatment refers to a combination of Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH), sensory integration therapy, and some ABA. Research has suggested that an intensive eclectic approach for pupils with autism is less effective compared to those receiving ABA-only intervention (Eikeseth et al., 2002; Howard et al., 2005).

In APS, the teachers embed the teaching of different skills in academic activities. Cheung, Lai, Leaf and Mountjoy (2020) conducted a study to evaluate the effectiveness of using embedded instruction to teach three pupils with autism to make spontaneous verbal requests in mathematics lessons. The targeted communication skills were different across the three pupils. Student A was expected to use clarifying requests such as "Not this one, I want [object]" when the teacher provided him with the wrong item. Student B's targeted communication skill was to alert the teacher when he was missed, for example, saying, "What about me?" when the teacher provided material to all classmates except him. The communication response for student C was stating, "I want [quantity] [object]" because he displayed deficits in requesting a specific quantity of an item. A non-concurrent multiple baseline design across participants was used. The result showed that all three pupils demonstrated an increase in both the targeted communication responses and academic skills

after the intervention. The study indicated that APS taught individualized target skills for pupils with autism, and it is effective to embed different targets in academic lessons. However, the result could be biased in favor of the school because the study was performed by the consultants and lead teacher in APS. Generalization of the acquired target skills was not assessed. Moreover, the intervention protocol was not described in detail because APS adapted a teaching approach that allowed for flexibility and clinical judgment during the intervention. It was not possible to collect treatment fidelity data.

Use of technology. Based on my direct observations, the teachers in APS utilize a combination of traditional teaching materials including pen and paper, books, whiteboards, real objects, and flashcards, as well as technology such as computer desktops, laptops, projectors, tablets and smartphones. The teachers use the gadgets as a reward to motivate the pupils with autism to behave and to learn, because rewards motivate learning and this is the backbone of teaching in ABA (Leaf et al., 2008). They also use them to help the pupils learn functional academic knowledge as well as general knowledge and community skills, play and leisure skills, language and cognitive skills, and how to communicate with others and follow routines. Cheung, Schulze, Leaf and Rudrud (2016) conducted a study to investigate the efficacy of using a self-managed activity schedule on a smartphone to teach two pupils with autism how to buy food from a local community bakery effectively. The study was conducted in APS, and a consultant from the school implemented the intervention. The researcher used a combination of traditional materials and technology including a cash card, a bakery menu, and five 6-page activity schedules on an iPhone. The digital self-managed activity schedule training started in the classroom in APS and then moved to bakery shops. The results showed that the two pupils were able to follow the smartphone's schedule to order items and generalized the skills to a new bakery. The study suggested that a digital self-managed activity schedule effectively taught community skills to pupils with autism. The authors

suggested that technology can be used with ABA for teaching multiple learning objectives for pupils with autism. This shows that teaching can be performed in different settings using portable electronic devices such as tablets and smartphones. Moreover, the use of gadgets may be less socially stigmatizing than using a book or an activity schedule in the community. However, the study did not provide an explanation regarding the benefits of technology use, and it did not investigate if there were any issues related to the use of screen-based media in the classroom.

Challenges

APS is the first and only autism school in Hong Kong. The school has the advantage of offering a specialized and tailor-made education for autism with a high teacher to student ratio. However, it does have some drawbacks, which will be described below under the following headings: exclusion, subjective evaluation, transition issues, high cost, limited capacity, and difficult to replicate.

Exclusion. The Hong Kong government has been advocating inclusive education for pupils with autism with average intelligence for over 40 years (Hong Kong Government, 1977, p. 4.2c). In 2015, the EDB published a handbook titled “Tiered Autism Intervention Model, Aiming for Integration and Maximizing Strengths” (AIM, Lee et al., 2015) to report on the positive experiences of the 30 primary schools in Hong Kong that implemented a support model for pupils with autism. This support model consisted of different varieties of teaching strategies, the involvement of teaching assistants, collaboration between schools and families, and support from multidisciplinary professionals. The EDB reported that the AIM had achieved many positive outcomes. More school staff participated in supporting pupils with autism, there was increased development of comprehensive plans and materials, and pupils with autism showed improvement on social communication and emotional regulation during the implementation of the AIM. On top of the benefits described by the government,

inclusive education in Hong Kong was developed based on the principles of human rights, social justice, and equal opportunity (Chong, Forlin & Au, 2007). The principles refer to the rights of an individual with autism in Hong Kong to learn in an educational setting free from discrimination and harassment. APS faces multiple challenges as a non-inclusive school. Firstly, it does not have government funding. Secondly, there is an absence of typically developing pupils in the school. Third, teachers have a lack of formal training in teaching academic subjects in ordinary schools. These challenges may affect the pupils' academic progress as well as the teachers' professional development in APS.

Subjective evaluation. In Hong Kong, pupils in regular primary schools are required to take the Territory-wide System Assessment (TSA) administered by the Hong Kong Examination and Assessment Authority (HKEAA) on behalf of the EDB. Since 2004, TSA has been used to enhance teaching and learning effectiveness by providing schools with information about pupils' performances in Chinese, English, and Mathematics (Hong Kong Examination and Assessment Authority, 2020). APS does not participate in TSA since pupils with disabilities are excluded from the assessment. Therefore, APS does not have an objective evaluation of whether the pupils have acquired the same essential skills that typically developing pupils have. For regular secondary school pupils in Hong Kong, most pupils take the Hong Kong Diploma of Secondary Education (HKDSE) examination offered by the HKEAA to gain admission to undergraduate courses at local universities upon the completion of six years secondary education. In APS, some older pupils may reach the age to take the HKDSE examination but may not end up taking it. For those who do take the HKDSE examination, it is unlikely that they will get results that meet the minimum requirements of university entrance because the teachers in APS are not trained to equip the pupils to take the public examinations. Moreover, APS adopts a curriculum that prioritizes individual needs and functional skills instead of exam-oriented skills, especially for pupils

displaying more aberrant behaviors or who are cognitively challenged. Hence, the academic needs of some pupils in APS may be overlooked.

Transition issues. APS claimed that 50% of pupils who left APS have transferred to regular schools successfully since its establishment (Aoi Pui School, 2020). However, the term "successful" is not defined. Moreover, there is no follow up data regarding how the pupils were doing in the mainstream setting and whether they dropped out of the schools. Au et al. (2015) described the challenge faced by APS that some parents of the high functioning pupils "prematurely withdraw their child [from APS] without appropriate collaboration with the upcoming placement, which further diminishes the chance of success for the student" (p. 138). This leaves open the possibility that even though some pupils have transferred back to a mainstream school, they may not be very successful in a regular educational setting.

High cost. Many families in Hong Kong cannot afford the school fees of APS for several reasons. First, the monthly school fee of APS is $25,500 Hong Kong Dollars, while the average monthly income of a family in Hong Kong is around $20,000 Hong Kong Dollars (Census and Statistics Department, 2020). Second, APS is a self-funded school where all the fees have to be paid by the parents. Plus, there are no subsidies from the Hong Kong government (Au et al., 2015). Third, Hong Kong is ranked as one of the world's most expensive cities (The Economist Intelligence Unit, 2020). Unfortunately, even though some parents may see that APS could bring potential benefits to children with autism, most families with fewer resources are unable choose APS for their children.

Limited capacity. Statistics show that the number of pupils with autism in ordinary public schools in Hong Kong increased from 2050 in the 2009-10 academic year to 10,300 in 2017-18. About one in 90 pupils at a regular school are on the spectrum. However, APS has a maximum capacity of 64 pupils. Only a tiny percentage of pupils can therefore benefit from the specialization of APS. At the same time, as APS is the only autism school in Hong Kong,

it is difficult to evaluate the quality of the service provided by APS because there is no competition. If parents prefer their child to attend an autism school in Hong Kong, they do not have many choices outside of APS.

Difficult to replicate. It may be challenging to replicate APS in the Hong Kong public school system because of its unique characteristics. First, intensive and ongoing training for teaching staff to learn ABA-based intervention is time consuming; furthermore, this training has to be provided from the very beginning because the local universities in Hong Kong do not have any ABA-related programs. Second, APS has a very high teacher to student ratio: up to one teacher for every three pupils. Despite the benefits of small class teaching in primary schools, such as more attention and individualized support for pupils (Hong Kong Education Bureau, 2009), small class teaching is not applied in mainstream schools in Hong Kong. Third, APS does not endorse the eclectic approach, while local schools utilize different methods for pupils with autism. The founders of APS claimed that commonly used teaching strategies such as facilities communications, sensory integration procedures, or social stories have no empirical support for their effectiveness (Au et al., 2015; Leaf et al., 2015). Last, running a school like APS is very costly. Without funding from any charitable organization or the government, most local families in Hong Kong cannot afford an autism school even if they see the potential benefits for their children.

Autism and ABA are my life and passion. I was very fortunate and honored to be involved in the setting up of APS in 2007. It was a breakthrough in ABA and autism education in Hong Kong at that time. Recently, more technology has been used to supplement ABA-based teaching in the school. Moreover, my wife has been working in APS for over 11 years. Therefore, I chose APS as the setting for this research to study progressive ABA, the benefits and issues of using screen-based media among pupils with autism, and how teachers manage technology use and related problems in the classroom.

Chapter Five: Technology

Information and communication technology (ICT) refers to any communication device, including computer, cellular phones, satellite systems, network hardware, software, television, radio, related services and applications such as distance learning and video conferencing (UNICEF, 2011). ICT is developing fast and is reshaping children's lives in both positive and negative ways, depending on how the technology is being used and managed (Lievens et al., 2018). Positive impacts include providing children with age-appropriate recreation and leisure, as well as education that supports their learning (Livingstone & Bulger, 2014). Negative impacts include opportunities for accessing adult materials and a risk of sexual exploitation, unmonitored interactions with strangers, cyberbullying, and criminal activities (Livingstone & Haddon, 2012). Personally, I am particularly interested in studying technology and autism because I have been working in AP in 10 countries for over 20 years. I have had many positive experiences using technology to teach students with autism. In 2015-16, I developed six mobile applications (“apps”) for autistic children. Some apps were designed for teachers to use as teaching tools. Other apps help students to acquire skills in language, social interaction, and communication. Over 150,000 downloads were recorded in total. This research focuses on the impact and management of desktop computers, projectors, tablets, and smartphones among students with autism because these gadgets were found to be commonly used in school settings in Hong Kong. In this research, different terms have been used to refer to the four tools collectively, including screen-based media, technology, electronic devices, and gadgets.

In Hong Kong, the Education Bureau has been providing ongoing support to primary and secondary schools in using technology, including the provision of subsidies to schools and students for purchasing screen-based media for learning in the classroom, staffing support grants, professional development programs on e-Learning, guidance on the

development of curriculum and plans for technology in education, information on security and e-safety, parent education, and technical support services for schools (Hong Kong Education Bureau, 2020). From January to May 2020 and in early 2021, all students in Hong Kong were expected by the government to stay home for online learning because all the schools were closed due to the COVID-19 outbreak. To help teachers prepare and deliver e-learning materials, the Education Bureau developed a series of informative resources for teachers on supporting students' home learning through e-learning during class suspension. In Aoi Pui School, the teachers conducted their lessons with the use of screen-based media. The teachers sometimes used the gadgets as a reward to motivate the students with autism to behave and to learn. Other times they used technology to help students to manage behaviors and learn functional academics, general knowledge, language, cognitive skills, play and leisure skills.

Karsenti and Fievez (2013) surveyed 6057 students and 302 teachers in Canada to investigate the benefits and issues of using screen-based media in schools. The findings demonstrated that using gadgets in school provided many benefits, such as increased student motivation, greater access to information, ease of organizing work, and greater collaboration among students and teachers. On the other hand, the results showed several challenges for both students and teachers—for instance, the electronic devices provided a distraction for the students. Hence, some students' academic performance suffered. This study had a large sample size and investigated both the positive and negative impacts on students. However, it did not describe the student participants. It is uncertain whether students with autism or with other special educational needs were involved in the study.

Odom et al. (2015) summarized 30 studies that documented the effectiveness of technology for adolescents with autism. Among the 20 studies conducted in the school context, eight showed that technology promoted independence, five indicated that technology

enhanced academic performance, three improved social skills, and other studies showed that it had a positive impact on students' communication, vocation and transition. In the following section, the literature regarding the use of screen-based media among students with autism will be summarized according to their uses, benefits, issues, and management.

Use of Technology among Students with Autism

Screen-based media seems to be commonly used among individuals with autism. Mazurek and Wenstrup (2013) characterized the amount of time and of television, video game and social media use among children and adolescents. The researchers asked the parents of 202 autistic children and adolescents, as well as 179 typically-developing siblings, to estimate the average amount of time their children spent in different activities outside school, including studying, reading books, hanging out with friends, physical exercise, watching television, playing computer or video games, using electronic mail, and social media. The results showed that children with autism spent around 62% more time watching television and playing video games than all other non-screen activities combined. Children with autism spent more hours per day playing video games compared with typically developing siblings, and children on the spectrum spent little time using social media or socially interactive video games.

Must, Phillips, Carol and Bandini (2015) showed that children with autism who were excluded by peers spent more time on gadgets than those who were not excluded by peers. One possible interpretation of the finding that children with autism may spend more time on solitary media play is that they do so because they experience social difficulties. Other possible reasons may be that video games provide a different variety of sensory stimulations, and are highly predictable compared to interacting with human beings. Also, electronic devices can be accessed easily. In general, households are well-equipped with screen-based media (Mazurek et al., 2012; Shane & Albert, 2008). On the other hand, Montes (2016)

surveyed the total screen time of 1393 parents of autistic children aged 6 to 17 years and 64,163 parents of children without autism. The results showed that children with autism and without autism had similar amounts of total screen time (3.21 hours per day vs. 3.46 hours per day) on video and computer/mobile devices. However, the study did not investigate what kind of content children engaged with, nor did it examine social versus solitary use of media.

Stiller and Mößle (2018) reviewed 47 studies covering the use of screen-based media among children and youths with autism. The main results showed that using electronic media is a preferred leisure activity for individuals with autism (Shane & Albert, 2008; Venkatesan, 2005). Different studies report that autistic children watch a variety of videos (Mineo et al., 2009) and play different types of games (Kuo et al., 2014; Mazurek & Engelhardt, 2013). The parents were found to manage their children's use of technology by setting rules and using the media together with their child (Finke, Hickerson & McLaughlin, 2015; Kuo, Magill-Evans & Zwaigenbaum, 2015).

Benefits of Technology Use among Students with Autism

Some research suggests that the use of screen-based media positively affects students with autism in many ways, particularly when technology is being used systematically with clear teaching objectives to address the needs of students. For example, such use can lead to improvements in level of engagement and on-task behaviors (Jeffries, Crosland & Miltenberger, 2016; Muharib et al., 2019; Vandermeer et al., 2015), language and communication (Alzrayer, Banda & Koul, 2019; Browder, et al., 2017), play and social skills (Lamash et al., 2015; Ringland et al., 2017), independence (Burckley, Tincani & Fisher, 2015; Cheung et al., 2016), and academic achievements (Burton et al., 2013; Hedges et al., 2018). Both parents and professionals have also been found to hold a positive attitude toward technology use for children with autism (Clark, Austin, & Craike, 2015). The benefits of using screen-based media among students with autism will be discussed in more detail below.

Behavior. Technology has proven effective for behavioral changes (Sturmey, 2003). Coyle and Cole (2004) showed that prompts can be provided by technology to reduce off-task behaviors for three children with autism in a classroom. Neely et al. (2013) compared the outcomes of an intervention delivered with a tablet compared to one delivered through traditional materials for two children with autism. The results showed that both participants demonstrated a higher level of engagement and fewer escaping or running away behaviors when the worksheet was presented on a tablet instead of pencil and paper. The study was replicated for two other children with autism (Lee et al., 2015). Similar results were found in one participant. Crutchfield et al. (2015) evaluated the functional relationship between a self-monitoring program delivered by technology and the reduction of stereotypic behavior of two autistic students. The results showed that both students demonstrated a marked reduction in stereotypy with the self-monitoring application. Jeffries et al. (2016) conducted a study to investigate the effectiveness of a mobile application to increase eye contact. The application required the child to look at a picture of a person's face and identify the number displayed in the person's eye. The results showed that it is effective in increasing eye contact in three children with autism. Muharib et al. (2019) showed that two children with autism demonstrated fewer challenging behaviors (self-injury and disruption) after using an electronic device to learn functional communication.

There are several plausible explanations for why the use of technology brings about behavioral improvement. First, students may find using electronic devices comfortable because technology is non-social, consistent and predictable. Second, the students might have a learning history associated with traditional materials, leading them to feel averse to such materials. Traditional materials may increase their motivation to engage in challenging behaviors and to attempt to escape from the lesson. Third, students might have positive associations with gadgets because of previous leisure experiences. The presence of an

electronic device might increase their motivation to learn and stay on task as they find using the gadget enjoyable during lessons.

Language and communication. Alzrayer, Banda and Koul (2014) reviewed 15 studies to determine the impact of tablets on the communication skills of students with autism. The results showed that electronic devices increased communication skills for people on the spectrum effectively. Flores et al. (2012) showed that five elementary students with autism increased communication behaviors when using screen-based media but showed no improvement when using picture cards. Five preschool boys acquired requesting skills at a faster rate by using a gadget than by picture exchange (Lorah et al., 2013). Three children with autism increased vocal requesting through iPad (King et al., 2014). Two autistic boys learned to use gadgets to request the continuation of toy play (Sigafoos et al., 2013). Three children with autism learned to use a tablet to perform a three-step communication sequence (Waddington et al., 2014). Also, the use of screen-based media effectively taught children with autism to discriminate between picture symbols (Lorah et al., 2014). Three 8- to 14-year-old children with autism displayed increased use of verbs or nouns with screen-based media (Ganz et al., 2014). Three out of four non-verbal children with autism learned to respond to the questions, “What do you want?” and “What is your name?” asked by peers (Strasberger & Ferreri, 2014). Technology has been shown to be effective in teaching story element definitions, labeling story element maps, and comprehension of story element questions (Browder et al., 2017). Three children between the ages of three and seven with autism were able to answer personal questions and perform a multistep sequence in requesting by using tablets (Alzrayer et al., 2019).

Play and socializing. Some studies have used screen-based media to promote social skills in students with autism. Murdock, Ganz and Crittendon (2013) showed that the use of story video clips on electronic devices increased pretend play skills of preschoolers with

autism. Two preschoolers with autism learned turn-taking behaviors through tablet-based intervention (Kim & Clarke, 2015). Portable video modeling technology increased complimenting behaviors of children with autism during athletic group play (Macpherson et al., 2015). Lamash et al. (2015) showed that 14 boys with high-functioning autism displayed higher rates of positive social interactions and collaborative play, and lower rates of negative social interaction, through the use of a tabletop display with multimedia elements. Ringland et al. (2017) suggested that communities around multiplayer virtual games such as *Minecraft* support the self-expression, sociality and learning of children with autism. Stone, Mills and Saggers (2019) observed the social interactions of children with autism through semi-structured interviews and at-screen observations. Their analysis showed that online multiplayer games provided platforms for children to use speech and gestures to engage in reciprocal conservation, make requests, give commands, share information and direct others. The students also used screen-based written texts to seek attention from others, discuss rules, and sustain engagements with other players within the children' physical and virtual worlds.

Independence. Cheung et al. (2016) showed that screen-based media effectively taught two students with autism to shop at the bakery. The students were taught to follow the pictures on a tablet or smartphone to make a purchase. The training began in a simulated shop in the school and then moved to a real bakery in the community. The teachers eased their supervision systematically to help the students to complete the purchase all by themselves. Burckley et al. (2015) conducted a study to teach a young adult with autism to follow a shopping list on a gadget in a grocery store across three community locations. Kim and Kang (2020) conducted a single-case multiple probe design to examine the effectiveness of video prompting and reinforcement for teaching multi-step cooking tasks for three Korean autistic adolescents. The results showed that the treatment package effectively maintained the skills for seven weeks following intervention across the three participants.

Academics. Burton et al. (2013) conducted a study to show that the use of video self-modeling was effective in teaching mathematical skills to four adolescent male students. Two adolescents with autism learned to check the spelling of words via tablet (Kagohara et al., 2012). A 5-year-old boy with autism demonstrated improved numeracy skills with technology use (Jowett, Moore & Anderson, 2012). Hedges et al. (2018) conducted a survey to investigate how secondary students with autism use technology in supportive ways. The results from the self-reported survey from 472 autistic students indicated many benefits including increased independence in doing homework, using the internet to find answers, using a laptop in class to take notes and becoming more productive writers with word processing.

Positive attitude. Clark et al. (2015) conducted a qualitative study to examine parental and professional attitudes towards technology use for autistic children. The results showed that both parents and professionals held positive attitudes toward the use of screen-based media. Fletcher-Watson et al. (2015) suggested that interventions delivered with gadgets promoted better engagement among students with autism, and the parents enjoyed the relaxed process of these kinds of interventions.

Technology and applied behavior analysis. Artoni et al. (2014) compared the learning progress between traditional and technology-enhanced ABA programs for seven autistic children. The result demonstrated that the students required less time to master new matching, receptive and expressive targets, and generalized previously mastered skills with a computer software. Artoni et al. (2018) further showed that technology enhanced the effectiveness of ABA for seven students with autism in terms of behavior, socialization, and communication. Ninety-one percent of the users, including the students, teachers, parents, and therapists, were satisfied with the outcome and process of using technology in the ABA sessions for students with autism. Health, McDaniel, Venkateswara and Panchanathan (2020)

suggested that multimedia data processing and machine learning could reduce the human cost of training and support with ABA to improve the communication skills of autistic children. Fisher et al. (2020) conducted a randomized clinical trial to evaluate a virtual parent-training program with e-learning modules and scripted role-play via a virtual private network. The researchers evaluated the ABA skills of parents using direct-observation measures in structured-work and play-based training contexts. The results showed that the parents in the treatment group demonstrated significant improvements on all dependent measures including ethics, preference assessments and positive reinforcement, verbal behavior, response prompting, natural environment teaching, compliance, preventing problem behavior, and integrating play-based training strategies. The outcome supported the efficacy and acceptability of virtually delivered training in ABA. Sosnowki et al. (2021) examined the feasibility, acceptability, and efficacy of video game-based digital therapeutic combining ABA techniques and gaze-contingent eye tracking to teach emotion recognition in children with autism. The results revealed that children in the intervention condition demonstrated significant improvements in emotion recognition from pre- to post-intervention compared to children in the control condition.

Limitations with the Evidence

The studies discussed in the previous section show the benefits of using screen-based media for students with autism. However, some of them had a small sample size of just one to four subjects (Chan et al., 2014; Jowett et al., 2012; Kim & Clarke, 2015; Vandermeer et al., 2015). It is thus uncertain that technology can benefit other students with autism. Also, some studies only investigate one or two types of technology. For example, Cheung et al. (2016) conducted a study to demonstrate the effectiveness of using a digital self-managed activity schedule to teach community skills to two students with autism in APS. Only two students were involved. The study investigated the use of smartphones only. Other screen-

based media, such as desktop computers, projectors, and tablets, were not included in the research. Also, it did not look into the limitations of using electronic devices in the classroom. On the other hand, some of these studies were conducted in individual therapy settings. It is questionable whether the students can learn the same behaviors and skills in a more natural learning environment, such as big group classrooms in a school setting. Furthermore, it is uncertain whether technology was responsible for promoting the progress of the participants because many other possible factors were affecting the outcomes, such as family involvement, health conditions, the environment and how the technology was being used.

Issues of Technology Use among Students with Autism

While technology can benefit individuals with autism, some research suggests that the use of screen-based media can negatively affect students with autism in many ways. For example, compared to the parents of individuals without autism, the parents of autistic individuals were more likely to report that electronic use was having a negative impact (MacMullin, Lunsky & Weiss, 2016). Issues included addiction (Chou, Condron & Belland, 2005; Howlin, 1998; Mazurek & Engelhardt, 2013), health issues (Corvey et al., 2016; Healy et al., 2017), behavior problems (Falcomata et al., 2013; Mazurek & Engelhardt, 2013), and ineffective to enhance skills (Fletcher-Watson et al., 2015; Kim et al., 2018; Miltenberger & Charlop, 2015). The issues of using screen-based media among students with autism will be discussed in more detail below.

Addiction. Howlin (1998) suggested that there might be a danger for autistic individuals to become addicted to technology. Latash (1998) claimed that autistic children might be unwilling to go back to the real social world after engaging with the virtual world. Parsons and Mitchell (2002) made a more robust criticism that by using technology to support learning, we somehow “collude” with children's disability” (p. 437)—they argue that

technology makes it more difficult for children with autism to want to interact with other people in the 'real world' given that they have difficulties in social interaction and communication (American Psychiatric Association, 2013). Boys with autism spend more time playing video games than typically developing boys (Mazurek & Engelhardt, 2013). Studies have highlighted addictive characteristics related to internet use, such as withdrawal when internet use is unavailable, a difficulty to manage screen time, and conflicts about use of internet involving youth both with and without autism (Chou et al., 2005; Kerkhof, Finkenauer & Muusses, 2011). Inattentive symptoms have been found to be strongly associated with problematic video games use (Mazurek & Engelhardt, 2013). Significant associations have also been found between autism, anxiety, and internet addiction (Romano et al., 2014).

Health. Some evidence suggests that autistic children may be at elevated risk for obesity, and one of the factors for unhealthy weight is less regular physical activity (Hill, Zuckerman, & Fombonne, 2015). There is a link between a lower rate of physical activity and higher levels of screen-time behavior (Healy at al., 2017). Corvey et al. (2016) conducted a study with a large sample size to examine obesity, being overweight, and physical activity in children and youth with and without autism. The researchers used nationally representative data. Over 95,000 people were contacted via a phone survey. The results suggested that children with autism had a higher likelihood of being overweight and demonstrating physical inactivity. Engelhardt et al. (2013) showed that the amount of time on video games was exclusively associated with less sleep among boys with autism. Healy et al. (2017) found that the status of being overweight or obese was more prevalent among 13-years-old with autism in Ireland. This may be related to physical activity and time spent watching television.

Behavior. Mazurek and Engelhardt (2013) examined video game use and related problems in boys with autism. The results revealed that inattention and oppositional behavior

was significantly correlated problematic video game use among a sample of 169 boys (ages 8–18) with autism. Falcomata et al. (2013) reported that destructive behaviors following the removal of electronic devices occurred 38%, 67%, and 92% of the time for three 8- to 10-year-old students respectively. In a study conducted by Hanley, Jin, Vanselow and Hanratty (2014), an 8-year-old boy with autism was reported to have emotional problems when parents or teachers said “no” and when there were environmental changes. He was reported to have frequent “meltdowns” when parents took away his gadget or interrupted his gameplay. “Meltdowns” refer to acts of screaming and aggression towards children and adults in both the home and at school.

Effectiveness. Fletcher-Watson et al. (2015) evaluated an early intervention for 54 children with autism on using technology to teach social communication skills. All children learned to attend to people and follow social cues on the app. However, none of them generalized the skill learned within the game to a real-world scenario. Allen et al. (2015) investigated 15 caregivers' perceptions regarding the potential for using an electronic device to enhance the communication skills of individuals with autism. The findings showed a conflict between the non-users’ assumptions and the users’ actual experiences. Non-users were more optimistic than the users toward technology’s effectiveness. Miltenberger and Charlop (2015) showed that video modeling did not result in improved progress of children with autism compared to traditional modeling procedures. Allen, Hartley and Cain (2015, 2016) compared the effectiveness of using screen-based media and books to improve symbolic understanding of pictures in children with autism. The results showed that the medium of presentation did not impact students' learning of names from pictures to real objects. The authors concluded that the nature of the picture being presented, especially the color and shape of the object, is a more influential factor affecting symbolic learning for students with autism than whether they are presented in a book or on a gadget. Agius and

Vance (2016) reported that three preschool-aged children with autism required more prompted trials and sessions to acquire requesting skills with a gadget than a physical form of the Picture Exchange Communication System (PECS). Kim et al. (2018) reviewed 695 apps listed on Autism Speaks. Among the 40 apps that were rated as having supportive "evidence" by Autism Speaks, the researchers found that none met their criteria of possessing direct evidence.

Limitations with the Evidence

Many of the studies discussed in the previous section regarding the impact of technology on individuals with autism rely only on parental reports in questionnaires (Healy et al., 2017; Hill et al., 2015; Mazurek & Engelhardt, 2013). In these studies, data was not objectively measured by direct observation or calculated objectively with any consistent measurement system, and there was no input from individuals with autism to gain data triangulation. Also, many studies investigated problems affecting students in their general lives (Chou et al., 2005; Kerkhof et al., 2011; Meerkerk et al., 2009). They did not give much information about the problems occurring at school, where students spend a considerable amount of time learning and socializing.

Management of Technology Use among Students with Autism

Students with autism often display challenging behaviors that may disrupt others and interfere with personal development, learning, and socialization. Challenging behaviors include stereotypic or repetitive behaviors (Leaf & McEachin, 1994; Lovaas, 1987), self-injurious behaviors, aggression, emotional outbursts, and sleep disturbances (Dominick et al., 2007; Murphy, Healy & Leader, 2009). Functional analysis (Iwata et al., 1982, 1994) has been commonly used in the field of ABA to identify the possible functions of aberrant behavior, and the results help ABA clinicians to develop behavioral intervention plans to address aberrant behaviors (Beaver, Iwata & Lerman, 2013). Functional analysis was further

developed to become more efficient (Northup et al., 1991) and comprehensive (Hanley et al., 2014). Therapists can use the knowledge of the functions of challenging behavior to prevent such behaviors from occurring. This can be done by changing the antecedent conditions to make reinforcement available when students are being taught to use alternative or replacement behaviors, and making sure that the reinforcer maintaining the aberrant behavior is not available when the challenging behavior occurs (Leaf et al., 2015). There are many effective behavior management strategies that address this, including response prevention, stimulus control, self-management, frustration tolerance programs, compliance programs, and social skill programs (Leaf, Taubman & McEachin, 2008; Taubman & Ferguson, 2017).

To my best knowledge, there are no previous studies that specifically examine how school teachers apply ABA principles to address problems associated with technology use among students with autism. Related studies are mainly concerned with how parents manage screen-based media at home. It has been suggested that many parents find the management of electronic media to be a source of distress in the family (Nally, Houlton & Ralph, 2000). Kuo, Magill-Evans and Zwaigenbaum (2015) explored mediation strategies used by parents to manage technology use in adolescents with autism. Parental mediation refers to strategies that parents use to control, supervise, or interpret the media content to which children are exposed (Warren, 2005). There are three types of mediation strategies, including restrictive, active and social mediation. Restrictive mediation means setting rules to control the type of content and amount of media exposed to children's media use. Active mediation refers to discussing the negative aspects of media content and ways of consumption with children. Social mediation involves sharing media experiences with children without critical discussion or purposeful instruction. The results of Kuo et al.'s (2015) study showed that parents mostly supervised their children by watching them play. Some parents used a combination of mediation strategies to regulate video gaming. Some parents only used social mediation

(Nikken & Jansz, 2006; Shin & Huh, 2011). Some used both restrictive and active mediation (Eklund & Bergmark, 2013; Nikken & Jansz, 2006). Engelhardt and Nazurek (2013) found that children display fewer challenging behaviors when the parents set rules at home.

All in all, it is not surprising that there is no consistent picture of the impacts of screen-based media for students with autism. Relevant studies demonstrate both positive and negative effects, and the impact of technology depends on how it is used and managed. Research on the management of technology use among students with autism in school is limited.

Chapter Six: Methodology

This chapter relates the methodology of the four parts of this study. It describes the aims and research questions, philosophical approaches, research design, participants and data collection, data analysis, ethical considerations, and limitations and difficulties.

Aims and Research Questions

This thesis aimed to investigate progressive ABA, the benefits and issues of using screen-based media among students with autism, and how teachers manage technology use and related problems in an autism primary school in Hong Kong. In particular, it aimed at answering the following research questions:

1. How do teachers use screen-based media among students with autism?
2. What are the benefits and issues related to the use of screen-based media among students with autism?
3. How do teachers use ABA-based interventions to manage students' behaviors related to the use of screen-based media?
4. Why do teachers select certain ABA-based strategies when managing behavior related to the use of screen-based media?

Philosophical Approaches to Educational Research

Cohen et al. (2011) describes the ontological assumption of positivism as reality is external to individuals. Reality is of an objective nature. It is 'out there' to be found out in the world. In contrast, interpretivism views reality as internal. Reality is of a subjective nature. Individuals create reality from 'within', which is at odds with the assumption of behaviorism. Based on Burrell and Morgan (1979), positivism assumes knowledge is objective, hard and tangible. It can be observed and identified through the use of scientific method. On the other hand, the philosophical view of interpretivism sees 'knowledge as personal, subjective and unique' (Cohen et al. 2011, p. 98). Positivism adopts a systematic approach to understanding

real and external natural phenomena, as evidenced by description, prediction and control (Cooper et al., 2014). Methods such as experiments, hypothesis testing, surveys, and quantitative research are used for testing. Interpretivism understands individuals' perspectives through conducting studies with individuals in context. Methods such as interviews, observations, case studies, and qualitative research are used to interpret subjective rules. In this research, I did not aim to reveal a correlation or functional relationship between technology and behavior (as would be in keeping with positivism). At the same time, I did not try to explain how technology affects autistic people individually (as would be in keeping with interpretivism). The objective of this research was also not to melt positivism and interpretivism together. This research aimed at exploring progressive ABA through the lens of technology use among students with autism.

Research Design, Participants and Data Collection

Yin (2018) defines a case study as a formal research method that goes beyond field-work that involves participant observation. A case study is an empirical method that "investigates a contemporary phenomenon in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident" (Yin, 2018, p. 15). It relies on multiple sources of evidence to help people to understand a given circumstance.

I chose to use a case study research method because I wanted to understand a real-world case of how teachers use ABA-based strategies to teach and manage the behaviors of students with autism through the use of technology. I had no control or deliberate influence over behavioral events during the investigation. My research questions focused on the 'hows' and 'whys' surrounding teacher management of students' behaviors and technology use in the classroom.

In preparing for the research, I conducted several phone conversations with the School Principal to obtain background information about the classes, teachers, and students before the school visits. The research took place in Aoi Pui School from 2019–2020 through four parts: 1) focus-group interviews with two teachers; 2) direct observations of twelve students from two classes; 3) individual interviews with four teachers who were teaching in the school; and 4) eight parental reports through a questionnaire.

I invited students with autism (aged 6-12), the teachers of the students who had been receiving ongoing ABA training in Aoi Pui School, and the parents of the students in the observed classes, to participate in this research. Since doing an in-depth study of a phenomenon in its real-world context potentially involves events over a period of time and with different people (Yin, 2018), this research aimed to gain triangulated data by getting evidence from the teachers, students, and parents. Triangulation of data combines data drawn from different sources and at different times, in different places or from different people (Flick, 2004).

I selected Aoi Pui School because it is the only school in Hong Kong for students with autism and the only school in Hong Kong that adopts ABA principles as the primary teaching approach. Also, I am very familiar with the setting as I was involved in the establishment and development of the school, and my wife has been working there for over 11 years as a school consultant. The two classes in this research were chosen for study because the teachers used English as a medium of instruction, and most of the students in these classes could use complete sentences for communication. The teachers were selected because they used screen-based media during their lessons. The parents of the students were invited to fill out a questionnaire to report how their children used gadgets at home.

Part One: Focus-group interview. Focus group interviews allow participants to interact to produce data and insights that would be less accessible in an individual interview

(Punch & Oancea, 2014). The objectives of the interview in this part were to generate ideas for the researcher to conduct direct observation, to get perspectives on how teachers use ABA-based strategies and screen-based media among students with autism, to refine questions for the individual interviews, to assess whether the questions gave information that the researcher is interested in, and to test how long the interview took.

Two teachers were interviewed as a focus group. They were selected based on the suggestion by the school principal. Both teachers were assistant teachers from two different classes. They used English as a medium of instruction and screen-based media during the lessons. They both have a bachelor's degree in psychology or education. However, their previous working experience were not revealed. They are labelled as Teacher A and B in this study. Since researchers should consider the participants' comfort, accessibility and the level of distraction at the venue (Smith, 1972), the interview took place in a function room after class time in Aoi Poi School so that the teachers would be more likely to attend.

One focus-group interview session was conducted in this part. The interview lasted for about one hour. The duration was kept short to prevent the participants suffering from fatigue (Nyumba, Wilson, Derrick, & Mukherjee, 2018).

The interview was conducted in English. During the discussion between the two teachers, I took notes to help generate prompt questions. An audio recording was used to make sure the data was accurately reported. Interview questions were all related to the use ABA-based strategies and screen-based media among the students with autism in Aoi Pui School. The questions mainly focused on 'what', 'how' and 'why', for example, 'What are the benefits and issues of using screen-based media among students in your class?', 'How do you manage these issues?', 'Why do you choose those approaches to manage these issues?' (Appendix D).

Part Two: Classroom observation. Direct informal observation was employed to observe how the teachers use ABA-based strategies and screen-based media among students with autism. It also helped the researcher to generate and refine questions for the individual interviews. Direct observation can cover actions in real-time and in a case-specific context (Yin, 2018). According to Robson (2011), informal observation is less structured. It allows the observer some flexibility in how and what information is collected. During the observations, I took notes every time the teachers and students used screen-based media (Appendix E). I recorded what the teachers and the students did with the devices and how the teachers managed the students' behavior when issues occurred. I only collected data that helped me to address the research questions: namely, how the teachers used technology with the students in the class, and how they managed issues related to the use of screen-based media. No sensitive information related to the teachers and the students was collected in this study.

The principal of Aoi Pui School suggested the two classes for this study because the teachers used technology to conduct their lessons, and they used English as a medium of instruction. The teachers who used technology to conduct the lesson with the students were being observed in this part. There were seven females and one male, aged 22-28 years. They were all full-time staff, had received induction and ongoing ABA training from APS, and one to four years of teaching experience in Aoi Pui School. They all have a bachelor's degree in psychology or education. However, their previous working experience were not revealed. Thirty-two lessons conducted by eight teachers were observed (20 hours in total). Each teacher was observed during individual lessons and group lessons. Each lesson lasted for 30-45 minutes. Twelve students with autism, aged 6-12, were observed in this part at the same time. I did not select the students for observation based on their age, gender and IQ. The principal suggested the students because they were able to use complete sentences for

communication so that they were able to complete a simplified consent form for this study. Some students were considered to have a below average IQ, and others to have an average IQ. A small sample size was unavoidable in this part due to the numbers of students in each class. This was a benefit, however, because it allowed for an in-depth understanding of how teachers use ABA-based strategies and screen-based media among students with autism. The part took place in the two classrooms at Aoi Pui School.

Part Three: Individual interviews. Semi-structured interviews were conducted to make sure all the research questions were discussed and to invite more open discussion. Also, it provided opportunities for the teachers to clarify the observed procedures in Part Two, and for me to get information on why and how the teachers used the ABA-based strategies observed in Part Two. More, the results helped me to generate questions for Part Four. I took an active role as an interviewer: I identified topics for discussion, used participant's responses to direct follow-up questions, and explored topics raised by participants to elicit more in-depth answers.

The four teachers who used technology to conduct the lessons during the classroom observation were invited for the individual interviews in this part. The teachers were all female. They are labelled as Teacher C, D, E, and F in this study.

There were a few primary questions for the participants to answer: for example, "Why did you use screen-based media in the class?', 'How do you prepare screen-based media for your lessons?', 'How do you feel about using screen-based media in general?' (Appendix F). When the resulting discussion did not cover all of the research questions, further prompt questions were asked. As suggested by Legard, Keegan and Ward (2003), I listened actively to the teachers, memorized their responses, and thought fast.

Each teacher was interviewed for one session, lasting about an hour. The teachers were interviewed at the school in a quiet and private room after class time.

Part Four: Parent questionnaires. I designed a self-completion questionnaire for the parents of the observed students in Part Two on how their children used screen-based media at home. This helped achieve the goals of this research and, in particular, to answer the research questions (Robson, 2011) regarding the benefits and issues related to the use of screen-based media among students with autism and how the related issues are managed. The questions were designed based on the results of Parts Two and Three. In keeping with Robson (2011, p. 255), the questions were also designed to avoid more obvious problems associated with questionnaires. As such, the questionnaire kept the language simple and the questions short, and avoided double-barreled questions, leading questions, and questions in the negative. All the items relate to how the parents view their children's use of screen-based media at home (Appendix G).

The parents of the students from the observed classes were invited to fill out a questionnaire about how their children use screen-based media at home and how they manage the related issues. The researcher asked the class teachers to put the questionnaires with a cover letter and a sealable envelope in the students' schoolbags. Twelve questionnaires were sent out. The parents had one week to fill out the questionnaire. The questionnaire was sent out as a hard copy because the parents are used to written communication with the schoolteachers. This is more convenient, direct, and the cost is lower compared to postal questionnaires and face-to-face interviews.

The details of the four parts of this study are summarized in Table 1.

Table 1. Details of the four parts

	Aims	Linkage	Participants	Research Procedures	Data Analysis
Part One: Focus-group interview	To get perspectives on how teachers use ABA-based strategies and screen-based media among students with autism; to assess whether the questions gave information that the researcher is interested in; and to test how long the interview took	To generate ideas for the researcher to conduct Part Two (Direct observation); to refine questions for Part Three (Individual interviews)	Two assistant teachers: one male and one female: aged 22-28; have a bachelor's degree in psychology or education; received APS induction and ongoing training; previous working experience were not revealed; labelled as Teacher A and B	Conducted in English; audio recorded; interview questions were all related to the use of ABA-based strategies and technology among students with autism; the questions mainly focused on what, how and why	Thematic analysis
Part Two: Classroom observation	To observe how the teachers use ABA-based strategies and screen-based media among students with autism	To generate and refine questions for Part Three (Individual interviews)	Eight teachers: seven females and one male; aged 22-28, have a bachelor's degree in psychology or education; received APS induction and ongoing training; previous working experience were not revealed Twelve students: aged 6-12, all males; English speaking; some students were considered to have a below average IQ, and others to have an average IQ	Direct observation; thirty-two lessons; 20 hours in total; observed and wrote down notes when teacher or students used technology in the classroom	Thematic analysis

Part Three: Individual interviews	To make sure all the research questions were discussed	To clarify the observed procedures in Part Two (Classroom observation); to get information on why and how the teachers used the ABA-based strategies observed in Part Two (Classroom observation); to generate questions for Part Four (Parent questionnaire)	Four teachers: all females; who used technology to conduct the lessons during Part Two; labelled as Teacher C, D, E, and F	Semi-structured interviews; the researcher took an active role as an interviewer: identified topics for discussion, used participant's responses to direct follow-up questions, and explored topics raised by participants to elicit more in-depth answers; Each teacher was interviewed for about an hour; interviewed at the school in a quiet and private room after class time	Thematic analysis
Part Four: Parent questionnaires	To answer the research questions regarding the benefits and issues related to the use of technology among students with autism; how the related issues are managed at home; to gain data triangulation	The questions were designed based on the results of Parts Two and Three	Eight parents: Seven mothers, one aunt of the students from the observed classes; labelled as Parent A-H	The questionnaires in hard copy were sent out with a cover letter in a sealable envelope in the students' schoolbags; the parents had one week to fill out the questionnaire	Quantity comparison

Data Analysis

Thematic analysis was used for analyzing the data from Parts One, Two and Three. Some quantitative comparison was done in Part Four. Thematic analysis is "a method for identifying, analyzing, and reporting patterns or themes within data" (Braun & Clarke, 2006, p. 6). When the procedures are clearly defined, it has the potential to demonstrate the rigor of qualitative data (Fereday & Muir-Cochrane, 2006). The 6-step approach to analysis proposed by Braun and Clarke (2006) was used. In Phase 1, I transcribed the audio recordings from the observations and interviews and read the transcriptions several times to familiarize with the data. During this process, I focused on studying the data instead of using my previous conceptions and experiences to interpret the potential impacts of using technology for student with autism and how ABA-based strategies could be applied to manage the related issues. I attempted to identify patterns by underlining the information related to the research questions at this phase and listed down some preliminary codes. For example, underlined information included 'iPad', 'academic', 'grabbed', 'waiting', and 'token'. In Phase 2, I made inferences about what the data means and created categories by combining data into labels. Initial codes were generated based on the data to find out how the teachers used screen-based media among the students with autism, the potential issues, and how the teachers managed the related issues. Examples of categories included teacher, student, content, benefits, issues and management. In Phase 3, I interpreted the codes and combined them to form a list of initial themes. The initial themes are phrases or short sentences that describe what the data means. For example, the teachers were observed and reported that they use token economies such as stickers, ticks and point system to reinforce the student keeping hands to themselves and following directions. The codes were interpreted and combined as proactive procedures for increasing behaviors. In Phase 4, I reviewed the themes by checking their coherence. I made sure the themes are consistent with and tell an accurate story about the data and they

addressed directly to the research questions. When the themes were found problematic, collapsed into each other or they had high degree of overlaps, I reworked the themes until they appeared to form a coherent pattern and fit together with the given codes. In Phase 5, I named, defined, and explained each theme in a few sentences. The name and description of the themes captured the essences of the data. For example, teaching the students to learn social and problem-solving skills were named as proactive strategies, that means strategies aim at increasing socially significant behaviors by teaching the students to acquire different skills based on the possible functions of the challenging behaviors, such as access to toys, attention seeking, avoidance or automatic reinforcement. In Phase 6, the analysis was reported to provide sufficient evidence of the themes within the data. During the whole thematic analysis process, I went through the six phases back and forth. I made several changes to the themes and connections between them until I was confident with the final themes. Some examples of the categories, codes and themes for each part of this study can be found in Appendix H.

Ethical Considerations

As a Board Certified Behavior Analyst (BCBA), I am expected to follow the Professional and Ethical Compliance Code for Behavior Analysts. Rosenberg and Schwartz (2019) commented that since the code was revised in 2016, it became a set of enforceable rules instead of a set of guidelines. The authors argued that a rule-governed approach can promote a rigid approach to ethical behaviors that do not adequately address the ever-changing, complicated, and diverse world that the Behavior Analyst Certification Board (BACB) practice in. According to Beauchamp (2007), it is rarely the case that we simply apply a principle to resolve a complicated moral problem. Hence, I addressed the ethics of this research based on multiple references and considerations.

Full ethical approval was granted by the School of Education Research Ethics Committee at the University of Bristol. Actions were taken based on the data privacy laws in Hong Kong as well as the university standards under the British General Data Protection Regulation. To ensure the highest possible level of ethical standards, specific care was taken to ensure that no harm was caused to the participants, especially the students with autism. In this research, I did not witness teacher behaviors akin to those described as harmful by autistic adults in their accounts of ABA. Other major ethical considerations were taken into account, including consent, confidentiality, and data protection.

There are several ethical considerations in this research. First, there are power differentials (Seale, 2012) between the teachers and I because of my role as a consultant of Autism Partnership Foundation, the managing organization of the school. Even though I do not have any direct work with the teachers in Aoi Pui School, the teachers may have felt pressured to take part in the research even though they may not have wanted to. Therefore, a consent form (Appendix A) with a description of my role as a researcher was presented and explained to the teachers. This form clarified that the objective of the observations and interviews was to collect data on how teachers use ABA-based strategies and screen-based media among students with autism. I did not judge or evaluate if their teaching or management was good or not, and I did not talk about their work with the principal or the administrators. They were informed that their decision to participate in the study (or not) would not affect their career growth and employment.

Moreover, the power differential may have affected the teachers' willingness to express their opinions during the interview freely. To address this, instead of using video recording in which identities can be disclosed through face recognition, an audio recording was used to facilitate more open communication in the interview. Moreover, the consent form stated clearly that the participants could withdraw from the study at any time, and this would

not affect their relationship with the organization. I also received consent from the parents (Appendix B) of the students in the observed classrooms because in the UK only children aged 13 or over are able to provide their own consent according to the Information Commissioner's Office. More, the students were aged 6-12 years and had autism, they may not have had the capacity to make informed decisions on whether to participate in this study. However, even though the students in this research were diagnosed with autism, they could answer simple "yes-no" questions. Hence, there was a simplified consent form (Appendix C) with yes/no tick boxes for the students. I asked the students if it was okay to stay in the class before each observation. The observations were conducted only with agreement from both the teachers and the students.

Second, the teachers were asked to share their professional experiences during the interview, meaning sensitive information regarding the students could be disclosed. Invasion of privacy has the potential to be harmful to participants (Seale, 2012). As such, I reminded all the teachers and parents of the students that I collected data only on how teachers manage issues related to the use of screen-based media among the students with autism in the school. When reporting the results, I removed any hints or information that could reveal the identities of the teachers and the students. No sensitive information related to the participants was collected in this study.

Third, there is a risk that after the study, data may be misused (Punch & Oancea, 2014) in a way that is not in the participants' interests. To build the trust of the participants, I ensured to all the teachers that their performance and point of view would not be discussed outside the interview, and their identities would not be disclosed in the study. Data was stored in the researcher's personal computer. The computer was password protected. I shared about 20% of the data with my supervisor. Based on the data privacy laws in Hong Kong, the Six Data Protection Principles (DPP 2- Accuracy and Retention Principles), I need to hold on to

the data for two years after submission to meet university standards under the British General Data Protection Regulation. It is important to be in line with Hong Kong laws to fulfill the purpose for which the data is used.

Fourth, there was a risk that teachers may have felt stressed and uncomfortable because I—the consultant of the managing organization of the school—was observing their lessons. Also, the students may have been distracted by my presence. To minimize the teachers' stress, I explained to them that the observations focus on how they use screen-based media, but not the performance of the teachers. To minimize the distraction of the students, I did not interact with the students and stayed at least two meters away from them during all the observation sessions.

I obtained informed consent from the teachers, students, and parents. They were well informed about the purpose, procedures, potential benefits and risks of the study, anonymity, the safety and wellbeing of participants, the complaints procedure, their right to withdraw, data collection, and data protection. The consent form for the students was simplified to help them to understand what was happening during the observations.

Limitations and Difficulties

This research was limited in that only one school was involved. The researcher observed twelve students, interviewed six teachers and received eight completed questionnaires from the parents. To minimize the interruption to the school, I did not conduct a pilot study, which could have helped to refine the content and procedure of the data collection plans (Yin, 2018). Nevertheless, a focus-group interview was conducted so that I could gain confidence in the procedures. In this research, the students and the teachers were observed only while at school. I did not investigate how the teachers use screen-based media with the students with autism outside school, such as at restaurants, cinemas, and shopping malls during outings. This is because this research focused on the teachers' and students'

behaviors in more structured settings. I did not interview the parents of the students to get a better picture of how they use gadgets at home. The data relied only on the parents' self-reports through a questionnaire because this method is less costly, as well as quicker and easier for the participants.

This research also shares some common limitations of data collection through interviews, observations, and questionnaires. Interviews are an essential source of case study evidence. However, the data may not be accurate because it relies on interviewees' correct and honest recall. Also, the conversation can lead to a mutual and subtle influence between the researcher and the interviewee, which may create reflexivity and response bias (Yin, 2018). To overcome these limitations, I rehearsed the interviews with some ABA therapists, and received feedback on how to conduct the interviews more objectively.

Observational evidence provides useful additional information about the topic being studied. However, it is costly and time-consuming. Participants may act atypically because they know that their behaviors are being observed. Observational bias due to selective attention, encoding, and memory may affect the results of observations (Robson, 2011). To minimize bias, I asked the teachers to review some of the notes taken during the observations.

Questionnaires are cheap and less time consuming. However, data is affected by many variables, such as the respondent's memory, knowledge, motivation, and personality. The participants may not treat the exercise seriously. Also, it is more difficult for me to detect ambiguities in participant responses and misunderstandings of the questions (Robson, 2011). Therefore, the questions were designed based on Robson's (2011, p. 255) suggestion to avoid the most obvious problems with questionnaires.

The four parts of this study were conducted from September 2019 to January 2020, a very difficult period of time in Hong Kong because of widespread protests due to the extradition bill crisis and the outbreak of a new strain of coronavirus (COVID-19). Many

schools in Hong Kong were suspended unexpectedly and the attendance of the students and teachers was inconsistent. Fortunately, I arranged the schedule before these events. Thanks to the support of the management and teachers at Aoi Pui School, all four parts of this study were able to be rescheduled flexibly and were completed before the month-long school suspension starting from February 2020.

Chapter Seven: Results

Part One: Focus Group Interview

The objectives of the interview were to generate ideas for me to conduct direct observations, to get perspectives on how teachers use ABA-based strategies and screen-based media among students with autism, to refine questions for the individual interviews, to assess whether the questions gave information relevant to the study, and to test how long the interview took. The group interview was conducted with two teachers from different classes for about 50 minutes. The results are summarized below according to the benefits, issues, and techniques of managing technology use in the classroom.

Benefits of technology use described by the teachers. The teachers thought that screen-based media is a powerful tool to motivate students to learn. Teacher A commented, *"In general, the reinforcing value of iPad is very high".* Through using technology, the students were able to acquire 'learning how to learn' skills, which refers to skills that have a pivotal role in teaching the students the process of learning, such as compliance and paying attention. It is the foundation that helps students to learn all other skills (Leaf, McEachin & Taubman, 2008). Teacher A gave the example, *"We use iPad for the attention because we have a lot of games, like find the differences with a time limit … they can actually train the attention within a time"*. On top of that, their students were able to learn language skills, social skills and academic skills through the use of photo or video software, educational apps, and timers. Teacher A said,

> *They can do some questions. It can be multiple choices. It can be typing in a paragraph. When they click the answer, the response will come up immediately. It tells them whether it's correct or wrong. And then they will learn it from the feedback immediately*.

The teachers used the timer app on the tablet to time student's activities, to teach them to go faster, and to understanding the concept of winning and losing. The teachers felt that it is more interactive and convenient to use technology with the students. Teacher A said, *"I think it is a very convenient way to show things, like we can just google images or browse videos from the iPad"*. Teacher B said,

> *It's a more interactive way because they can click, they can describe. Maybe there are some problem-solving things. They can sort out how to unlock the iPad, how to click it, how to download the game, how to choose the free game, the most popular games*.

The benefits of technology use described by the teachers are summarized in Table 2.

Table 2. Benefits of technology use described by the teachers

Technology use	Benefits of technology use described by the teachers
Photos/video	Reinforcement breaks; following procedures; describing; social games; arts and crafts
Educational apps	Academics; sight words
Timer	Reinforcement breaks; being fast; winning and losing

Issues of technology use described by the teachers. Despite these benefits, the teachers found that screen-based media could trigger disruptive behaviors, and affected learning and socialization. Even though technology was used as a powerful tool to motivate students with autism to learn, Teacher A reported that *"it diminishes the reinforcing value of other toys or other reinforcers"*. On one hand, technology helped the students to demonstrate learning how to learn skills such as paying attention. However, as Teacher A commented, *"It's quite distracting to other students as well. When they're playing games, or watching video, the sound would actually distract others from having lesson"*. Teacher B shared a similar concern: *"Too much video I think it's not only on iPad and also on computer. When they come back to the lesson, they are less focus because there are lots going in the brain"*. Self-stimulatory behaviors were also seen as interfering with how students communicated with others. Teacher A shared, *"Sometimes I find the students speak in a tone or manner of videos in a very animated way. Maybe this is like, the result of watching too much video. The accent is like Siri or something"*. Screen-based media was often found to be convenient to use, yet Teacher A mentioned that sometimes this can lead to disruptive behaviors:

> *The technical problems will make them throw tantrums because they don't have the patience to wait and they don't know when it will be fixed. And this is not whether we want to fix it or not, it's because they have to wait when there's no internet. We can't help.*

The issues of technology use described by the teachers are summarized in Table 3.

Table 3. Issues of technology use described by the teachers

Issues	Issues of technology use described by the teachers
Disruptive behaviors	Temper tantrums; grabbing; quarrels; swiping; snatching; pushing; blocking; non-compliance; crying
Affects learning	Inattention (looking away); self-stimulation (scripting)
Affects socialization	Complaining; turning away; shoving
Other	Not choosing other activities or toys; spending too much time sitting down (less exercise)

Management of technology use described by the teachers. To manage the issues described in the previous section, the teachers reported that they used a combination of proactive and reactive strategies.

Proactive strategies. These strategies aim at increasing socially significant behaviors by teaching the students to acquire different skills based on the possible functions of the challenging behaviors, such as access to toys, attention seeking, avoidance or automatic reinforcement (Iwata et al., 1984). Teacher B explained the different proactive programs they use with students at different levels of functioning. For those who were less capable,

> *We do systematic desensitization. We will do it more frequently at the very beginning, and then try to generalize them and then make them feel calm, or actually you can voice out 'I want to play longer', 'I want the iPad back', and then report to us.*

For students of higher functioning, Teacher B stated,

> *We actually use priming and we'll use discrimination training and teaching interaction. We will spot the problem first and then take that problem out and we use a lesson to talk to them, help them to know the rationale of the problem and how would others feel, and how the teacher, the friends and your parents feel when you're doing this stuff. And then we'll have different kind of demonstration. We will identify the problem, maybe we take a video in the iPad and then he will find a problem.*

Teacher A described a program to help a student who had problems with emotional control to stay calm:

> *I actually prioritize his tolerance against other students' preferences for his games and his reinforcement first… when the individual student who usually got interrupted, he's actually getting calmer now through different tolerance programs, like he's well aware that these triggers are going to be presented and nowadays he can like report to the teacher in a way calmer manner.*

During the interviews, the teachers also discussed some other proactive programs they implemented in the classes, including teaching the students communication skills, perspective taking, keeping a distance from other students, turn taking, playing alternatives, being a good friend, social awareness, developing interests, discrimination training, reporting to a teacher, compromising, voting, and understanding 'first come, first served'.

Reactive strategies. These strategies aim at decreasing challenging behaviors by antecedent-based procedures (such as priming and limiting access to screen-based media) or consequence-based interventions (such as removal of the device upon presentation of challenging behaviors, and providing tokens and verbal praise for the absence of challenging behaviors). Teacher A said, *"I'll set a timer for them. When the timer beeps, they need to stop playing right away then pass it to next one"*. Teacher B explained,

> *For those who cry because they got interrupted in the middle because there is somebody snatch and grab the iPad… we will have them apart first and then take away the iPad. And then we will first of all calm the kid who was actually crying and then we'll do incompatible tasks [a task that cannot be performed at the same time as the challenging behavior]. And then we'll do some calm token as well, we'll go back to task and make him work for the iPad again.*

The strategies for managing technology use described by the teachers are summarized in Table 4.

Table 4. Management of technology use described by the teachers

Strategies	Management of technology use described by the teachers	
Proactive strategies (Teaching what to do instead)	Behavior management	Waiting (sitting and placing hands nicely); tolerance; staying calm (emotional control); self-evaluation
	Social skills	Communication; perspective taking; keeping space; turn taking; playing alternatives; 'Rock Paper Scissors'; being a good friend; social awareness; developing interests; discrimination training; reporting to a teacher; compromising; voting; understanding 'first come, first served'
Reactive strategies (Teaching what not to do)	Antecedent-based intervention	Priming; turning down the volume; limiting availability; using a projector, distracting the student; separating students
	Consequence-based intervention	Tokens for the absence of the disruptive behaviors; termination of preferred activity

Part Two: Classroom Observations

Direct informal observation was employed to observe how the teachers use ABA-based strategies and screen-based media among students with autism in the classrooms. Eight teachers and 12 students participated in this part. The participants were observed for 32 lessons (20 hours in total) from two classes across four days.

Observed use of technology in the classroom. The results showed that the teachers used desktop computers the most in their lessons. The projector remained on for around 25% of the total observed period. There were three to four desktop computers in each observed classroom. As the projectors were connected to the desktop computers, I classified the time when both were on as projector time. The second most frequently used media in terms of total number of uses in lessons were iPads or tablets. Smartphones were observed to be the least used media in the classroom, possibly because the school did not provide these devices. The teachers therefore had to use their personal smartphones for teaching purposes in the class. It was observed that teachers also used digital timers, electronic calculators, and laser pointers with the students during the lessons occasionally. Furthermore, the supervisors and lead teachers used their personal laptops for lesson planning. During the whole observation, the researcher counted how long the devices were used with the students, not including the time that the teachers worked on the devices for their own purposes.

The different uses of technology observed in the classroom are summarized in Table 5.

Table 5. Technology usage observed in the classroom

Technology type	Total lessons used	Total time used
Desktop Computer	21	460 min
Projector	10	298 min
Tablet	19	182 min
Smartphone	5	81 min

Observed benefits of technology use in the classroom. There were several ways in which the benefits of using technology were apparent. The researcher observed that the students demonstrated enhancements in knowledge, skills acquisition, behavior, meaningful attending, verbal communication, and social and play skills through the use of screen-based media. The strategies were used individually based on the students' needs.

Knowledge enhancement. Through watching videos on YouTube and surfing on Google and Wikipedia on desktop computers and projectors, the students were observed to learn mathematics and language, which included expanding their vocabulary; describing; using comparatives, superlatives and conjunctions; writing stories; and comprehension. They also learned general knowledge including information about movies, natural disasters, senses and functions. With the help of tablets and smartphones, the students were observed to learn describing, drawing and place value during the lessons as well.

Skill acquisition. The teachers used desktop computers for the students to learn different computer skills through online games and word processor programs. These skills included using a computer mouse, finding photos, typing, copy-pasting, saving files, printing documents, and searching for new information. Projectors were used to teach students to read together. Tablets and smartphones were observed to help the students to check the spelling and meaning of words, discriminate between 'good' and 'not good', and for self-evaluation.

Behavior enhancement. The teachers were observed to target the 'learning how to learn' behaviors of the students through the use of screen-based media. The teachers used desktop computers and tablets as a reward to reinforce the students for completing tasks correctly and independently. The students watched videos on YouTube and played online games, which served as a replacement skill for self-stimulatory behaviors. The teachers used the timer app on their smartphones and showed a timer game on the projector to motivate students to complete different tasks quickly within a time limit.

Meaningful attending. Paying attention is important for the children as it promotes language development (Podrouzek & Furrow, 1988) and social interactions (Leekam et al., 1997). When the students paid attention to screens in the classroom, they were able to acquire information and complete relevant tasks. With the use of the projector, the students could watch their classmates typing with word processor programs. The teachers also introduced the camera function on their smartphones for students to take videos of their classmates' interactions.

Verbal communication. The students were taught to seek help from their teacher when they came across problems on the desktop computer. There were many opportunities for the students to respond to questions and initiate communication while they were using screen-based media. The teachers showed information on the projector to facilitate group discussions among students. Throughout the observation, the students used spontaneous speech to express their desire to play the gadgets more. For example, when one student saw the teacher using an iPad, he said, *"I want iPad"*. When the teacher ignored his request, he walked up to the teacher and said, *"I want iPad please"* a few times. When the teacher asked the students to stop playing with the desktop computer during a reinforcement break, some students verbally requested, *"I want to play longer"*. A student even verbally explained why

he should have more time to play with the electronic device every time he requested to play more.

Social and play skills. The teachers provided students with some play ideas through video demonstrations on a desktop computer before they were sent to play with Play-Doh and blocks. Presentations were conducted by students with the use of projector. It allowed the students to ask questions and answer each other. Even though the tablets were used individually, there were a few devices available for the students to use together.

The benefits of technology use observed in the classroom are summarized in Table 6.

Table 6. Benefits of technology use observed in the classroom

Benefits	Desktop	Projector	iPad/tablet	Smart phone
Knowledge Enhancement	Describing in sentences; writing stories; comprehension; what's next; conjunctions, comparatives and superlatives; vocabulary; functions; days of the week; general knowledge about movies; weather; natural disasters; senses	Same as desktop; learning about measurement	Senses; place value; reference for drawing; describing	Reference for drawing; describing; talking clearly

Skill Acquisition	Using a computer mouse; finding photos; typing; copy-pasting; saving files; printing documents; finding the same; finding out new information	Reading together	Checking words; discriminating 'good' vs 'not good'	Discriminating 'good' vs 'not good'; self-evaluation
Behavior Enhancement	Independence; replacement of self-stimulation; motivating learning (reinforcement)	Responding faster	Same as desktop; being fast; motivating learning	Motivating learning; being fast
Meaningful Attending	Sustaining on-task behaviors with the desktop computer	Watching classmates typing	Sustaining on-task behaviors; looking at self-behavior	Looking at self-behavior
Verbal Communication	Asking for teacher's help	Discussion; responding to teacher's questions	Responding to teacher's questions; initiating talking	Responding to teacher's questions
Social and Play Skills	Imaginative play skills	Responding to classmates' instructions; turn taking	All students can stay together with multiple devices	

Observed issues of technology use in the classroom. The students exhibited stereotypic behaviors, non-compliance, temper tantrums, inattention and other challenging behaviors related to the use of screen-based media during the lessons. The teachers experienced technical issues with the devices during their lessons as well.

Stereotypic behaviors. Stereotypic behavior is one of the major diagnostic features of autism. Some adults with autism describe repetitive behavior as self-soothing (Kapp et al., 2019). However, it greatly interferes with learning because it affects attention; it is highly reinforcing to the students, which makes more adaptive reinforcement less appealing; and it is stigmatizing. During reinforcement breaks, the students were observed to watch particular segments of videos about rollercoasters, water slides and Peppa Pig repeatedly on desktop computers. They also engaged in other forms of stereotypic behaviors while watching the clips across different types of screen-based media, including snapping their fingers, flapping their hands, rocking their bodies, bouncing on chairs, and making verbal noises.

Non-compliance. It was observed that some students did not respond to the instructions given by the teachers while information was presented on the projector. One student argued with the teacher repeatedly about the content on the screen. Some students left their seats during the lessons. Sometimes the teaching was delayed because the students did not stop playing on the desktop computer or tablet when the teacher asked them to come back to work.

Temper tantrums. One student was observed to display multiple forms of challenging behaviors when the teacher used a tablet to teach during their individual lessons. The student requested to have the iPad from the teacher repeatedly. When the teacher refused to let him have it, he reacted by sucking his finger forcefully, whining, and grabbing. The behaviors further escalated to shouting, pulling the teacher's clothes and running around.

Being distracted. In many lessons the students were assigned to small groups to work on individualized goals with different teachers at different stations in the classroom. While the students were working on a desktop computer or tablet, they sometimes deviated to play on apps or websites that were irrelevant to the lesson. For those who were not working with

screen-based media, they were often distracted by the sounds or scenes from the devices used by other students.

Other challenging behaviors. The students were required to transit from one area to another area in the classroom to get a tablet or a desktop computer. It was observed that sometimes the students wandered around during the lessons. One student ignored the teacher's request to stay in the group with all the other students, who were sitting together at the big table learning through the projector. The student sat at the corner of the classroom most of the time while he was still able to see the content on the projector screen.

Technical problems. It was observed the teachers experienced a number of technical problems with the desktop computer, including the display not working, no internet signal, and poor sound quality. When technical problems occurred, the students' learning was interrupted. This also affected other people in the class because there were a few occasions where another teaching staff member had to stop their lesson to help fix the technical problems.

The issues of technology use observed in the classroom are summarized in Table 7.

Table 7. Issues of technology use observed in the classroom

Issues	Desktop	Projector	Tablet	Smartphone
Stereotypic behaviors	Snapping fingers; flapping hands; rocking body; jumping, bouncing on chair; biting collar; verbal stimulation; bending down; looping video repeatedly; watching age-inappropriate content	Wiggling body; flapping hands		
Non-compliance	Leaving seat; delaying work	Arguing with teachers; not responding; leaving seat		
Temper tantrum			Whining; requesting repeatedly; grabbing; touching; walking around; shouting; pulling teacher's top; sucking fingers forcefully upon denial of request	
Inattention/ distracted	Looking at irrelevant content; getting distracted by desktop	Getting distracted by other students from a different group	Getting distracted by the sound	Tapping another student's phone
Other challenging behaviors	Walking around; shouting	Calling out; requesting repeatedly; shouting; staying away	Grabbing; touching objects	

Computer technical error	Display not working; display not supporting full screen	No signal; white screen covered half of the whiteboard	Poor sound quality

Observed management of technology use in the classroom. The teachers were observed to use a combination of proactive and reactive strategies to address the students' issues. Examples of proactive strategies included teaching the students to stay calm, to play and to improve their communication skills. Reactive strategies included the use of corrective feedback, removal or reinforcement, and response blocking.

Stereotypic behaviors. Proactive strategies focus on teaching a student what to do instead of engaging in stereotypic behaviors. During the lessons, it was observed that the teachers reinforced students for answering questions and completing independent work without stereotypic behaviors. There were also programs to help the students to monitor their own behaviors, and to develop their leisure and play skills. On the other hand, the teachers used different reactive strategies to address stereotypic behaviors. When a stereotypic behavior did not occur, the teacher provided different forms of reinforcement based on individual needs, such as verbal praise, tokens and offering them their choice of activity. When the stereotypic behavior occurred, the teachers reacted with different procedures including walking to the student, providing corrective feedback, removing tokens, or terminating the preferred activity the student was engaged in.

Non-compliance. The teachers were observed to use token systems and verbal praise to reinforce the students for answering different questions as a proactive strategy to address non-compliance. During the lessons, the teacher interspersed easy instructions with difficult demands to maintain students' motivation to answer. When students answered correctly, the teacher gave them a tick or a point with a verbal praise. The students were rewarded with a reinforcement break time of their own choice of activity after they collected a specific

amount of ticks or points. When a particular student did not follow instruction, the teacher reactively provided corrective feedback by telling him that he did not answer or listen. For the student who was required to collect points, one point was deducted every time he failed to answer. It was observed that when another student made repeated requests when the teacher gave instructions, the teacher ignored his behavior and verbally redirected him to work on what he was supposed to be doing. Some students did not follow the teacher's instruction to stop a preferred activity. To address this, the teacher proactively set up the activity repeatedly for the students to practice how to stop playing with the desktop computer or return the tablet upon the teacher's request. Students were also taught to use speech to communicate their desire to play for a longer time. To reduce the chance that students refused to stop playing with screen-based media, the teacher often set a time limit with a digital timer to signal the end of the activity. Sometimes the teacher waited for the student to finish a computer game or fast forwarded a video to the end before asking them to stop. When students refused to stop the activity, the teacher used different reactive procedures to address the situation, including giving verbal reminders, removing the device or turning off the video.

Temper tantrums. The teachers set up stressful situations repeatedly to increase students' tolerance levels by systematically presenting triggers of different stress levels for the students to practice self-control. For example, the teachers denied one student's requests for gadgets purposefully and then provided him with tokens and verbal praise for keeping nice hands and staying quiet instead of grabbing and shouting. Furthermore, the teachers proactively addressed temper tantrums by teaching the students to recognize emotions, monitor self-behaviors and communicate their desires using speech. When students engaged in temper tantrums, the teachers reacted with different procedures based on the possible functions and forms of the behavior and situations. The reactive strategies included giving

corrective feedback, removing tokens, terminating the preferred activity, response blocking, and redirection with minimal verbal attention to the challenging behaviors.

Inattention. Token systems were used to reinforce students for paying attention while other classmates were playing with gadgets. Some students received ticks while others received points for looking at and listening to teachers. One token system was presented in the form of a meter to target a student for responding quickly. When a student was distracted by gadgets, the teacher applied different reactive procedures including removing a token with corrective feedback, walking to the student, and encouraging them to ask the classmate to turn down the volume, to get another toy, or to go back to their seat.

Other challenging behaviors. The teachers addressed other challenging behaviors by teaching the students verbal communication, as well as waiting and turn taking skills. As some desks were closer to the area with all the desktop computers, the teacher sometimes swapped the students' seats or managed the seating arrangement in a way to prevent some students from being distracted by the screen-based media.

Technical problems. When the teachers experienced technical issues, they often sought help from other teachers or used a different device.

The methods of managing behavioral issues related to technology use are summarized in Table 8.

Table 8. Management of technology use observed in the classroom

Issues	Examples	Proactive strategies	Reactive strategies
Stereotypic behaviors	Snapping fingers; flapping hands; rocking body; jumping; bouncing on chair; biting collar; verbal stimulation; bending down; looping video repeatedly; watching age-inappropriate content	Reinforcing answering questions and independent work; developing leisure and play skills; self-monitoring	Walking to the student; corrective feedback; crossing out 'pay attention' on whiteboard; removing tokens; loss of reinforcement; reinforcing absence of stereotypic behaviors
Non-compliance	Requesting repeatedly	Reinforcing students to follow different instructions	Ignoring; redirecting to work; response cost (minus 1 point); corrective feedback
	Did not stop the activity	Intensive practice on retuning reinforcement; praise following directions; verbal communication	Verbal reminders; removing the computer mouse; stopping the video; repeating instructions; using digital timer; moving the video to the end when the timer was about to go off
Temper tantrums	Whining; requesting repeatedly; grabbing; touching; walking around; shouting; pulling teacher's top; sucking fingers upon denial of request; arguing	Teaching to recognize emotion; monitoring behaviors; verbal communication; differential reinforcement of incompatible behavior; nice hands and quiet system	Removing tablet; redirecting to work; giving minimal attention to the behaviors; giving token for the absence of the aberrant behaviors; praising other classmates for being quiet; crossing out 'keeping nice hands' on whiteboard; response blocking
Inattention/ distractions	Leaving chair to look at device; walking around	Meter system; flipper system for being fast and attentive; token system, reinforcement for paying attention	Asking to turn down the volume; walking to the student; blocking and asking student to go back to chair; verbally reminding student to get another toy; token system with crosses

	Getting distracted when others were playing	Reinforcing paying attention to teacher	Corrective feedback
Other challenging behaviors	Touching; grabbing; pushing others	Teaching verbal communication; waiting; turn taking	Moving away device/mouse; praising for absence of the behaviors; swapping seats
Computer technical errors	No signal; forgotten password; TV not working, TV not supporting full view; poor sound quality		Other teachers helping; asking other teachers; using another device; using earphones with a microphone

Part Three: Individual Interviews

Semi-structured interviews were conducted after the classroom observations to understand how and why the teachers use ABA-based strategies and screen-based media among students with autism. This part provided me with opportunities to ask teachers for clarification of some behaviors and events observed in Part Two. Moreover, I was able to get more information about the students' behaviors, past events and management strategies that did not occur during the classroom observation. The interviews also gave teachers the opportunity to share their perspectives. All in all, this part helped me to gain a more complete picture on how teachers manage the use of technology among students with autism in the classroom, and a more in-depth understanding of the reasons behind some decisions made by the teachers. The individual interviews were conducted with four teachers from two classes for an average of 27.5 minutes per session.

Benefits of technology use described by the teachers. The teachers offered many positive comments regarding the use of screen-based media for the students with autism. These were consistent with the benefits observed in Part Two, highlighting enhanced knowledge, skill acquisition, behavior, meaningful attending, and social and play skills.

Knowledge enhancement. The teachers thought that using screen-based media was effective in helping the students obtain knowledge and process information. Teacher C said, *"It teaches them how to process information through watching a video or listening to sound tracks"*. Teacher D concurred:

> *It's easier to explain to students with the visuals and with different types of information. It is actually easier for them to understand. For example, I'm having a science lesson right now. It is hard to just tell them which body parts, the functions of each body parts of the process in the digestive system, but with the use of video it's actually a lot easier and fun.*

Cohen (1998) suggested that individuals with autism are visual learners rather than hearing learners. Visual strategies are suggested to be effective in helping autistic students to learn through visuals and technology (Rao & Gagie, 2006). Teacher C also shared that some knowledge was better presented through technology:

> *For science or integrated studies, they will put quite a bit of time of using the screen because there are a lot of experiments. I think in general there are a lot of resources online that they can access to.*

Skill acquisition. The teachers reported that the students learned different computer skills through screen-based media. Teacher D enjoyed seeing her students making movies with the tablet: *"During the movie lesson we talk about how to make a video, so they really like having iPad and take the movie by themselves"*. Also, the students acquired language skills through gadgets. Teacher E reported, *"Some of the students may type on a computer better than writing on the piece of paper"*. Teacher F added, *"They learn how to take notes from PowerPoints"*.

Behavior enhancement. The teachers observed better behavior and performance from most students in general when screen-based media were used during the lessons. Teacher E talked about using gadgets as reinforcement to promote self-control:

> *One of my students uses iPads as reinforcer to decrease some forms of behaviors, include decreasing the time that he was not paying attention, and decrease the number of times that he gives comment during the lesson, and to increase the time that have self-control to keep his hands nicely during the lesson.*

Teacher F also mentioned a similar observation: *"When you use more media like computers and projector, it's less likely they can play around with the materials compared to traditional materials… I use them as like a little embedded reinforcer"*.

Meaningful attending. All the teachers appreciated the use of screen-based media to enhance students' attention. Teacher F stated, "*Some of them sustained attention throughout the long video*". Teacher D shared,

> *In my classroom, we have a student who usually looking outside to the door, or to the window. But when we're using the projector, he will turn this head back to the teacher, or to the friends. I'm hoping it decreases daydreaming behaviors.*

Teacher C also mentioned the use of a projector to help the students to *"shift their attention between information on the whiteboard and then transfer to textbook"*.

Social and play skills. The use of screen-based media in the classroom provided the students with more opportunities to play different computer games and videos. Teacher C found that *"one of them really likes typing game, and we actually discover this when we teach him to type"*. Moreover, this teacher described an enhanced interest in one of her students:

> *[I have] seen some of them have an increase in interests on watching video… six months ago, the student would not be interested at all in watching the videos. But once we have started to introduce this in our lesson and to incorporate our teaching, he actually would pay more attention. His eyes are always on the screen and then watching it.*

Teacher F also talked about the students' interest level: *"A lot of them actually quite enjoy watching the projector that because they feel like it's like a big video time for them"*. Teacher C shared her plans to promote socialization with technology:

> *I've seen how they do group project together on the screen. I think as I have mentioned social interaction is one of the main focuses for our students, I think that's a good starting point as well to build up their social interaction, how they can talk to each other, and make something on the iPad, on the PowerPoint.*

On top of the benefits observed in Part Two, the teachers reported that the students gained skills that may transfer to other settings, were more engaged, and that both the teachers and students benefited from the user-friendliness of screen-based media in the classroom. These benefits are described below.

Generalization. Some parents of the students in Aoi Pui School aimed at transferring their children back to a mainstream school when they were more equipped and ready. The teachers thought that the use of screen-based media in the class helped to prepare the students to go to other schools in the future. Teacher A talked about her vision at the beginning of the interview:

> *I think it's a very common type of media to use in school settings. And when I observed other school's teaching, I've seen them using similar items and I think it's important for my students if they were to go back to other schools. It is important for them to know how to use these devices and get used to learning through different media.*

Teacher F found it more natural to use technology for teaching in the class: *"Using the projector, more like having a lesson with them. It feels like they have a lesson outside. It's like normal school"*.

Engagement. All the teachers spoke positively about the use of screen-based media as fun and engaging. Teacher D said, *"It's actually more interactive and more engaging to use those multimedia sources… it's more fun and students like it. When they like it, they are more engaging and less behaviors"*. Teacher E also found that *"the students are more interested to the lesson and it's another variety forms of teaching as well"*. Teacher F used technology to increase students' engagement:

> *"[Technology helps in] making everything more fun, more appealing to the students. I'm sure a lot of them love watching videos and their attention is more on the video than on me, and I will use it as like a big reward for everyone.*

User-friendliness. The teachers described the use of screen-based media as fast, easy and convenient. Teacher D said, *"We can be more creative and we can find lots of information online, so it's easier to prepare, and it's less time consuming"*. Teacher F compared the use of technology and traditional teaching materials:

> *If we were preparing traditional material there's always a limit, there's always something like, because we only have that much of it, but using like a gadget base we can search whenever you want out like at the moment like straight away, or we can show some pictures straight away.*

Aside from being user-friendly, Teacher C also mentioned that technology is *"environmentally friendly"*.

Among the four types of screen-based media, all the four teachers expressed that they like to use projector the most for their students with autism in the classroom because all the students can use it together. Teachers C explained that she likes to *"use the projector the most because it's the biggest and everybody can look at it versus if we use smaller screens, not everybody can see it properly"*. Teacher D said that "*it is easier to demonstrate our information, and at the same time, a lot more students can look at it at the same time"*. Teacher F expressed that using a projector for the lesson feels like the students are learning in a *"normal school"*.

The benefits of technology use described by the teachers is summarized in Table 9.

Table 9. Benefits of technology use described by the teachers

Benefits	Benefits of technology use described by the teachers
Generalization	More common, across media; very common in other schools; natural like a normal school; prepares students to go to another school
Engagement	Increases interest; high interest, motivates students, use as reinforcement, students enjoy them, embedded reinforcement; more fun, interactive and engaging
User-friendliness	Faster, convenient, shows process, decreases paper use; everyone can see, environmentally friendly; pick up information faster, can highlight certain information, flexible; easier to prepare, easier to explain with visuals, less time consuming, for more students, prepare ahead of time
Knowledge Enhancement	Effective, learn from video modelling; helps process information; obtain information from videos and PowerPoint; easier for students to understand
Skill Acquisition	Some students type better than write, take video; expanding skills, develop vocational skills, pick up words, PowerPoint for presentation, type during break time, a lot of resources online; self-learning
Behavior Enhancement	Innovative, decreases inattention/excessive hand movement/ inappropriate commenting, reduces frustration, self-control, keeping nice hands; increases attention; better behavior and performance for everyone, do task properly; sustain attention, reduce self-stimulation; less unwanted behaviors
Meaningful Attending	Shifts attention to different media; decreases down time
Verbal Communication	Search information by speech recognition
Social and Play Skills	Sharing; increases interest in leisure skills, promotes social interaction through group project
Teacher’s enjoyment	Teacher can be more creative

Issues of technology use described by the teachers. The teachers described a few issues with using screen-based media in the classrooms that were consistent with the observations in Part Two, including stereotypic behaviors, non-compliance, temper tantrums, inattention, and technical problems. These issues are described below.

Stereotypic behaviors. Self-stimulation was a concern for teachers as it sometimes interfered with students' learning. Teacher D said, *"Some students would get overstimulated when they spend too much screen time. It's hard to get them back to the lesson"*. Teacher E talked about a student who was obsessed with horror and natural disaster movies, which sometimes led to *"some self-talking for self-stimulation"*.

Non-compliance. Some teachers discussed the issue of students not following instructions right away upon the termination of screen-time activities. Teacher C reported, *"I have seen some students that will have difficulty when we try to take the iPad away from them, like we terminate the break time"*.

Temper tantrums. Teacher C shared how disruptive behaviors may start out mild and then build to a more intense level: *"They might scream, say 'No' quite loudly, crying, and then that will lead to an episode which can last for a period of time, which means that the student cannot get back to work until he's calm"*.

Inattention. The teachers were concerned that students' attention may be affected by excessive use of videos. Teacher D commented, *"Electronic devices may make students inattentive if watch video for too long time"*.

Technical problems. The teachers came across some technical issues when they used screen-based media in the classroom. Teacher C said,

> *The games might not load quickly enough and that could be a problem. Some of them like to watch YouTube and that could be quite difficult in a place where we do not have Wi-Fi. Sometimes it might run out of batteries and that also could be a*

> *problem… Some students quite insist on using the iPad and that could become some of the problem for behavior because they will think that they're not getting what they want.*

Teacher D talked about how it affected students' learning: *"With the students who are less proficient on technology, they may spend more time on learning the computer skills rather than on the course materials"*.

On the other hand, the teachers identified some additional problems beyond what the researcher observed in Part Two; namely, online risks and social related issues. These issues are described below.

Online risks. The teachers reported a number of potential risks associated with the use of screen-based media. Teacher D commented,

> *On our computers we do not set a restriction on what information they can access. They literally can search for anything on the internet, and we really have to pay close attention to them. Some of them like watching disastrous videos or some violence.*

Teacher E raised similar concerns:

> *I worry about the online security a lot, especially they know how to use a computer, and they may go online, after work especially when I'm not by the side to monitor how they use the internet, or how they access some trash emails.*

Potential access to age-inappropriate content also bothered Teacher F: *"I sometime concern what they might search using iPad… he is not really good at typing but he knows how to use the voice [recognition]. I think that's a little bit concerning at that age [8 years old]"*.

Social issues. Some teachers reported the negative impact of using screen-based media on students' socialization. Teacher C shared of a student,

> *[He] would be playing on the iPad so much that he doesn't really want to play games with his peers. But as we know that children with autism will have the deficit of social*

> *interaction and if they play iPad so often that actually decreases the social opportunities for them.*

Teacher E added,

> *Another student enjoys watching video about disaster. It sometimes effects how he speaks or has conversation with his friends… he may ask, or talk about horror movie or life disaster movie a lot when he is chatting with his friends. And it will be a social issue for me and one of my concerns.*

The issues of technology use described by the teachers are summarized in Table 10.

Table 10. Issues of technology use described by the teachers

Issues	Issues of technology use described by the teachers
Online risks	Online security, spam emails; age-inappropriate content
Social issues	Excessive talking about disaster and horror movies, affects conversational topics; less social interaction; obsession
Stereotypic behaviors	Too many disaster and horror videos, obsession, self-talking; overstimulation, risk of disruptive behaviors
Non-compliance	Harder to get back to lesson
Temper tantrum	Crying, screaming, hitting, grabbing; shouting, being upset or confused
Inattention/distracted	Cannot get back to learning, takes away from learning time; student does not understand
Other challenging behaviors	Excessive requesting
Computer technical error	Internet speed issues, device not working in other places

Management of technology use described by the teachers. The teachers elaborated on the proactive and reactive strategies they take to manage the students' issues related to the use of screen-based media. Proactive strategies were used to teach students what to do by properly selecting a replacement behavior that the student is capable of learning and that effectively serves the same functions as the challenging behavior. This involved breaking down the skills into teachable parts, repeated practice, flexible prompt fading and effective use of reinforcement. Reactive strategies were used to teach students what not to do by implementing procedures that increase the costs and reduce the payoffs of a behavior. Antecedent-based reactive procedures are executed before a behavior occurs, while consequence-based reactive procedures are implemented after a behavior occurs.

Proactive strategies. The teachers shared details about teaching the students to perform 'learning how to learn' behaviors as proactive targets, including paying attention, staying calm, being compliant and exercising self-control. Teacher C said that the behaviors she aimed to increase were *"responsiveness and attention… the ability to sustain controlling his or her behavior"*. Another focus was to help the students to understand reinforcement contingencies or "*how they understand consequences*":

> *One student gets rewards but at a certain point if he continues that process, he actually gets reinforcement time deducted in the later round because we're trying to get him to understand that his bad behavior is now would affect the consequences in the future. So that we tailor made these programs, or the system based on their understanding and what reinforces them, and what motivates them.*

Teacher D also targeted similar behaviors, including *"pay[ing] attention nicely, sitting nicely, responding fast, keeping eye contact"*. In addition to that, the teachers proactively taught the students other skills. Despite teaching the students to pay attention, Teacher C also described *"teach[ing] them how to process information through watching a video or*

listening to sound tracks, to obtain information from those things". To replace temper tantrums and non-compliance behaviors, Teacher D described some social skill targets, including *"talking smoothly, keeping personal space, using a polite term when talking to friends"*. To address the technical problems, Teacher C came up with goals to teach her students:

> *Computer skills as well. For my students because they're seven. They grow older, children of this age they need to hand in homework through online platforms or they might need to prepare PowerPoints and to do presentations. They might do different projects that are using the internet to look for information. So these kinds of skills I think is also important for them to learn and hope to teach them.*

Antecedent-based reactive strategies. The teachers described the procedures they used to prevent the issues related to screen-based media from happening. All of the teachers talked about the balanced use of technology and traditional teaching materials. Teacher E chose to restrict the use of gadgets for one student:

> *We try to avoid using the electronic for teaching materials or for his reinforcer… we have mentioned and discussed with parents about that too. Parents also trying to avoid watching TV or something related to electronic devices as break time or free time at home.*

Another preventative measure described by Teacher F was to set up an activity whereby a *"teacher sat next to him, make sure that he chooses a nice video or something, appropriate to watch. And then we let him to watch it for a certain amount of time"*.

Consequence-based reactive strategies. The teacher explained the consequences that were implemented to reduce challenging behaviors. To increase the cost of a behavior, Teacher D described a response-cost system that involved the removal of a certain amount of reinforcement contingent upon the occurrence of the target disruptive behaviors:

> *We would like to decrease their leaving seat behavior, daydreaming, responding slowly or not responding to instructions. Some of them are not working well with friends, using not a friendly tone of voice. ... If they're not doing good, we may take off their tokens, or resetting their timers, so it's clear to them how they are performing.*

Furthermore, Teacher F explained the procedure of providing reinforcement for the absence of excessive behaviors:

> *We are trying to catch good [behavior] a lot during the time to give him ticks and to remind him that you keep going to leave really takes away your five minutes break, or you still have chances to get your five minute breaks, you can get iPad for five minutes.*

Teacher C described a comprehensive point system to reduce unresponsive behavior of a student:

> *If he was acting silly, or if he didn't respond to teacher that he would get points deducted. At the end of the day we will evaluate his performance, and he can get his A grade reinforcement if he can score 80% of the full mark. For each lesson he can get a maximum of 10 points. Let's say in the day he has nine lessons that he needs to get at least 72 points in order to get the A grade reinforcement.*

Teacher C further explained the considerations of using a token economy system:

> *We chose token system for some of the students because they are learning the relationship between the behavior and the reinforcement as the consequence that they gain. And then once I've gone through that stage that we're talking about sustaining it for a longer period of time or to become more independent, and then think about some students who are not using system at all because they're getting to a stage where they're trying to fade away the system, and to have more control, and to use things*

that naturally reinforcing or to just learn based on teachers feedback, just verbal feedback and praises and to adjust their behavior.

Combination. Based on the descriptions given by the teachers, I found that multiple challenging behaviors were addressed at the same time through a combination of proactive and reactive strategies, rather than just using one strategy to target one behavior. Teacher E gave an example:

To help the student stay calm, we tell the student that we are going to practice staying calm. And you are going to respond me a question right away. Just one question with one circle, so he knows that he is going to answer one question. If he stays calm and responding fast, he can get the iPad right away after. And we use some gesture prompts when we pause the video. We also have a reminder before we stop the video. I would say, 'In five more seconds I will pause your video'. And then when we pause the video, I will use the gesture to remind him to stay calm. And if you stay calm, I would say, 'Oh you were so calm, so here's a question'. I'll give him the instruction. If he responds right away and calm then he would earn the tick, and keep going on the iPad. We increase the length of the task gradually.

Collaboration with parents. Another way of addressing issues related to the use of screen-based media was a collaboration between the teachers and parents. Teacher C explained as follows:

We will evaluate the behavior in school and the parents will reinforce the student at home. So, I will then communicate with the parents, say how many minutes he plays on the iPad on that particular day. And then actually another student's parents don't want the child to play the iPad at all. So, the mom said that he's not getting any access to the screens at home. They want us to not give him iPad to play during the

> *daytime as well. We actually do not let him to play iPad during the daytime. But he has access to other screen-based media in terms of learning.*

Teacher D also advocated parental involvement:

> *We communicate with them through WhatsApp or email. For some of the homework, the students have to do a weekend activity with the parents. So they have to take a photo or video and send it back to school to show us.*

Teacher F had a lesson called ‘sharing sessions’ which required support from the parents as well:

> *This is when parents will send us photos of what happened on weekend, and then we will project it on the big screen and then they have to stand in front of the screen and then showcase. So I guess the parents know that they are using those pictures to learn to do public speaking.*

The techniques of managing issues related to technology use described by the teachers are summarized in Table 11.

Table 11. Management of technology use described by the teachers

Issues	Proactive strategies	Reactive strategies
Online risks	Communicating with parents	
Social issues	Asking friends to join, setting up social communication programs, play programs	Balancing the use of screen based and traditional teaching materials
Stereotypic behaviors; non-compliance; temper tantrums; inattention/being distracted; other challenging behaviors	Reinforcing fast responses, keeping nice hands, staying calm for a short to long duration, self-control programs, practice; sustaining attention and on task behavior, assessment from other professionals; teaching following rules, reinforcing responding, self-control, meaningful attention, understanding contingencies, independence, using natural reinforcement; students need to work for it	Differential reinforcement of other behavior/alternative behavior, restricting access, daydream programs, response cost, selecting screen-based media based on students' strengths, weaknesses and preference, adjusting the content based on student's understanding
Computer technical errors	Teaching how to use software, teaching computer skills (typing, touch typing, remembering user names, using PowerPoint, submitting online homework)	

Part Four: Parent Questionnaires

A self-completion questionnaire was designed for parents of the students observed in Part Two to give information on how their children used screen-based media at home and how they manage the related issues. Eight completed questionnaires were received out of twelve observed children. Seven respondents were mothers and one respondent was the aunt of an observed child. They were labelled as Parent A-H in this study.

Use of technology reported by the parents. The results showed that the most frequently used gadgets at home were smartphones (on average 3.9 hours/week) and tablets (on average 2.75 hours/week), whereas in school smartphones were the least frequently used device. No respondent reported using projector at home. The types of technology usage reported by the parents are summarized in Table 12.

Table 12. Technology usage reported by parents at home

	Desktop (hour/week)	Projector (hour/week)	Smartphone (hour/week)	Tablet (hour/week)
Student A	2	0	8	8
Student B	0	0	3	3
Student C	0	0	2-3	3
Student D	0	0	10	1
Student E	0	0	3.5	0
Student F	0	0	2	0.5
Student G	0	10	1	0
Student H	1	0	1	1

All of the respondents reported that the children used screen-based media for personal entertainment and gaming at home. Sixty-three percent of the respondents observed their children using the gadgets for learning. Fifty percent used the gadgets for taking photos or videos. One respondent commented that she observed more use of gadgets when on public transport and during holidays. The purposes of technology use reported by the parents is summarized in Table 13.

Table 13. Purposes of technology use reported by the parents

	Total number of checks
Homework	3
Learning	5
Personal entertainment/gaming	8
Taking photos/videos	4
Social communication	1
Utilities (e.g., timer, torch)	1

Benefits of technology use reported by the parents. The parents observed benefits of using screen-based media at home that were similar to those derived from using technology at school. All of the respondents agreed that technology enhanced the children's knowledge. Parent B commented, *"The positive side is the child is learning new knowledge at times"*. Sixty-three percent of the respondents found that it helped their children to acquire skills and to be engaged. Parent A wrote, *"My child starts to use screen-based media since very young. From nursery rhymes to flash card games, now she also plays games that are educational, like mathematics or phonics. Her interests expand"*. However, 63% thought that it had no positive impact on children's behavior management, attending, verbal communication, social and play skills, and generalization. Parent D wrote, *"I don't think screen-based media can help the child replace stereotypic behaviors and social communication skills"*.

The benefits of technology use reported by the parents are summarized in Table 14.

Table 14. Benefits of technology use reported by the parents

	Not positive at all	No impact	Positive	Very positive
Knowledge enhancement (e.g., language, cognition, academics)	0	0	8	0
Skill acquisition (e.g., computer skills, motor skills, reading skills)	1	2	4	1
Behavior enhancement (e.g., independence, replacing stereotypic behaviors, motivating learning)	3	3	2	0
Attending	2	4	1	1
Verbal communication	1	4	2	1
Social and play skills	2	4	2	0
Generalization (i.e. applying skills across settings/people/media)	3	3	2	0
Engagement (e.g., increasing interests, enjoyment)	1	2	4	1
User-friendliness (e.g., speed, convenience)	1	3	3	1

Issues of technology use reported by the parents. The results showed that the reported negative impact of using screen-based media on children varied across parents and issues. Some issues were seen as being impacted by screen-based media more than others. Sixty-three percent of the respondents thought that technology had a negative impact on their children's stereotypic behaviors. Fifty percent reported that it had negative impact on their children's inattention. Parent C wrote, *"Sometimes when he's enjoying what he's playing he tends not to hear us and I have to repeat for his attention"*. Fifty percent were also concerned about social issues. Parent A noted, *"The more my child spent time on his digital devices, the less interactions he would have with us or his peers"*. This parent also mentioned, "*It's little bit hard to strike a balance between how much time of iPad, iPhone, computer time and not having them"*. Thirty-eight percent associated technology with temper tantrums. Parent B shared that *"[when] the child is too engaged in using screen-based media sometimes he will show negative emotions if not allowing him to use the mobile phone or tablet"*. On the other hand, 63% were not concerned about online risks. Fifty percent thought that it had no impact on non-compliance and temper tantrums.

The issues of technology use reported by the parents are summarized in Table 15.

Table 15. Issues of technology use reported by the parents

	Not negative at all	No impact	Negative	Very negative
Stereotypic behaviors (e.g., obsession, repetitive body movement/talking)	1	1	5	0
Non-compliance	0	4	2	0
Temper tantrums (e.g., crying, screaming, aggression)	0	4	2	1
Inattention/being distracted	0	3	3	1
Online risks (e.g., inappropriate content, online security)	1	5	2	0
Social issues (e.g., isolation, inappropriate talking)	0	4	4	0

Management of technology use reported by the parents. The parents reported that they used different strategies to address their children's issues related to screen-based media. Parent D wrote that if they *"combine some different methods in one case, the effect will be better"*. Among all the possible strategies, the most common was verbal reminders, which was used by 100% of the respondents. Parent C noted that they *"remind what he is not allowed to watch and play before he's given the gadgets"*. The second most popular strategy, used by 75% of the parents, was issuing praise or reward for the absence of challenging behaviors. Removal of preferred items or activities and teaching compliance were strategies chosen by 63% of the parents. Fifty percent reported that they gave minimal attention to the challenging behaviors and taught alternative behaviors such as verbal communication, turn-taking, waiting, play skills, and social skills. Thirty-eight percent tried to reprimand their children. Parent C shared, *"If he doesn't listen, I will try to talk in a strict manner"*. However, Parent D thought that *"reprimand for the small child may work but for the elder one is useless. They only argue with you"*. Thirty-eight percent used timers. Parent D stated,

"I will let my son to play smartphone as a reward and set time restriction for 15 min". Other strategies used by the parents included redirection, using tokens, physical enforcement and self-monitoring. In addition, Parent C said that they *"observe what he is watching or playing and step in"*. To address reduced social interactions, Parent A reported, *"I would play with him together so there would be discussion and exchange of what we each learned"*. Parent D shared her opinion that *"every way can help the child. The important thing is how they work and what characteristic about the students… teachers, parents and students cooperate are very important"*.

The techniques for managing technology use reported by the parents are summarized in Table 16.

Table 16. Management of technology use reported by the parents

	Total number of checks
Reprimand	3
Removal of preferred item or activity	5
Praising or rewarding the absence of challenging behavior	6
Ignoring/giving minimal attention to the challenging behavior	4
Redirection	2
Verbal reminders/Priming	8
Physical enforcement	1
Timers	3
Tokens	2
Teaching alternative behavior (e.g., verbal communication, turn-taking, waiting, play skills, social skills)	4
Teaching compliance/following rules	5
Self-monitoring	2

Summary of Findings

All in all, the benefits of using screen-based media were very much consistent across the reports from the teachers, parents, and during my own observations. The benefits include enhanced knowledge, skill acquisition, behavior, meaningful attending, verbal communication, and social and play skills, as well as the potential for generalization, engagement and user-friendliness. On the other hand, I observed issues related to technology use similar to those reported by the teachers. However, the parents reported more diverse views about the issues, including the connection between technology use and stereotypic behaviors, non-compliance, temper tantrums, inattention, online risks and social problems. Management of behavioral issues related to technology use was found to involve a combination of proactive and reactive strategies, and collaboration between the teachers and parents. It seems that the potential benefits and issues of technology related to children's learning and behaviors depended on how the technology was being used and how the potential issues were being managed.

The findings of the 4 parts of this study are summarized in Table 17.

Table 17. Similar and diverse findings in the 4 parts of this study

	Similarities	Differences
Part One: Focus-group interview	The students with autism used technology both in school and at home mostly for entertainment (e.g., watching videos); showed both positive (e.g., knowledge enhancement) and negative effects (e.g., stereotypic behaviors) on technology use for students with autism in all the 4 parts of this study	The teachers described more benefits; identified more effective ABA-based strategies and used a combination of proactive and reactive strategies to manage challenging behaviors related to technology
Part Two: Classroom observation		The researchers observed that desktop computers were used most frequently; students benefitted from technology in social and play skills; observed more issues related to technology use
Part Three: Individual interviews		The teachers described more benefits; identified more effective ABA-based strategies and used a combination of proactive and reactive strategies to manage challenging behaviors related to technology use
Part Four: Parent questionnaires		The parents reported that children with autism used smartphone most frequently; did not use projector at all; described more issues, 75% of respondents did not have favorable responses for the benefit of technology in social and play skills; mainly used reactive procedures (e.g., verbal reminder, removal of preferred items or activities) to manage challenging behaviors related to technology use

Chapter Eight: Discussion

Overview

This study investigated how teachers use ABA-based strategies and technology among students with autism in Aoi Pui School. In particular, it aimed as answering how and why screen-based media is used in the classroom; the benefits and issues associated with this use; how teachers use ABA-based strategies to manage behaviors related to technology use; and why they choose those particular management strategies. The results showed that screen-based media was used for various purposes. Technology impacted students both positively and negatively. The teachers used clinical judgement in a structured yet flexible manner to implement a variety of strategies based on ABA principles to manage students' behaviors related to technology use. In this chapter, the findings will be discussed in relation to the research questions under the following sections: use of technology; impact of technology in the classroom; attitudes to technology use; relationship between technology and behavior; autism, progressive ABA; limitations; and conclusion.

Use of Technology

This study found that students with autism used screen-based media both in school and at home mostly for entertainment, such as for playing games and watching cartoon videos. This finding is in line with previous research (Finke et al., 2015; Kuo et al., 2014; Mazurek et al., 2012).

The results of Part Two (the classroom observation) showed that the students in Aoi Pui School used desktop computers most frequently for watching videos and playing games. The main reason for this is that the teachers often used external reinforcement to motivate students to learn and behave well (Au et al., 2015). Reinforcement should be used contingent upon the occurrence of a target behavior following a predetermined schedule (Leaf & McEachin, 1999). The students in Aoi Pui School were observed to play on desktop

computers or tablets upon the completion of a task or token economy while demonstrating good behavior, such as showing that they were putting in effort and sustaining on-task behaviors. Many students earned a reinforcement break two to three times within a 45-minute lesson. It is perhaps not surprising that the teachers allowed students to play video games and to watch cartoon videos with the gadgets: as suggested by some of teachers from Aoi Pui School, technology provides different varieties of stimulation and excitement, which promotes student engagement (Mineo at al., 2009). Furthermore, these activities constitute solitary play and as such do not require a teacher's involvement and supervision, as compared to other forms of reinforcement such as playing board games or physical activities. During these breaks, the teachers could therefore focus on lesson preparation or teaching other students. Even though the teachers were observed to use screen-based media for teaching, they used the gadgets only occasionally; they also used traditional physical materials such as white boards, books, physical objects and flash cards as media of instruction.

The results of Part Four (the questionnaire for parents) are consistent with the observations in Part Two and with previous literature (Stiller & Mößle, 2018). The parents revealed that their children use screen-based media at home mostly for entertainment. A parent reported that "*during holiday he [the student] use more time [to play with gadgets]*". Another parent noted, "*I will let my son to play smartphone as a reward*". The questionnaire did not directly ask the parents why they thought their children use these gadgets for entertainment. However, based on a review conducted by Durkin (2013), there are five influential factors that make video games attractive to young people with autism: they provide active control and challenges; they can be non-social; they are consistent and predictable; they provide an escape from reality to fantasy; and they can represent an obsessive interest. Even though Durkin did not review these factors in light of other forms of

entertainment on screen-based media, it is sensible to infer that those factors also make watching videos and playing different types of apps attractive to the children.

Impact of Technology in the Classroom

There is no consistent picture of the impacts of technology use for students with autism, as many studies describe both positive and negative effects (Stiller & Mößle, 2018), and the impact is possibly affected by how the technology is used as well as how the potential issues are managed. This research found that the use of screen-based media as a supplementary tool in the classroom benefited students with autism in many ways that are in line with previous research. Benefits included improvements in behavior (Coyle & Cole, 2004; Neely et al., 2013; Vandermeer et al., 2015), language and communication (Alzrayer et al., 2019; Ganz et al., 2014; Strasberger & Ferreri, 2014), play and social skills (Murdock et al., 2013; Kim & Clarke, 2015), independence (Burckley et al., 2015; Cheung, 2016), and academic achievements (Browder et al., 2017; Burton et al., 2013; Kagohara et al., 2012).

It is not surprising that this research also showed that screen-based media at times impacted students with autism negatively. Issues included behavior problems such as oppositional behaviors (Engelhardt & Mazurek, 2013) and inattention associated with technology use (Mazurek & Engelhardt, 2015), addiction (Chou et al., 2005; Howlin, 1998; Mazurek & Engelhardt, 2013), health issues (Corvey et al., 2016; Healy et al., 2017), and ineffectiveness (Fletcher-Watson, 2015; Kim et al., 2018; Miltenberger & Charlop, 2015). The positive and negative impacts of technology use among students with autism in this research in relation to previous literature will be discussed in more detail below.

Behavior. ‘Learning how to learn’ is a foundational and pivotal skill that allows students to acquire all other skills (Leaf et al., 2008). As observed in Part Two, the students demonstrated some satisfactory ‘learning how to learn’ behaviors such as attending, staying on task, and persistence associated with the use of technology. The teachers also reported

similar observations in Part Three. A teacher said, '*When you use more media like computers and projector, it's less likely they can play around with the materials compared to traditional materials"*. This result is consistent with previous literature that suggests technology use is associated with behavior enhancement, including higher levels of engagement and less attempts to escape or run away (Lee et al., 2015; Neely et al., 2013), increased on-task behaviors (Vandermeer et al., 2015), decreased off-task behaviors (Coyle & Cole, 2004), and a reduction of stereotypic behaviors (Stephen et al., 2015). It should be noted that, in the present study, the researcher suggests that playing games on screen-based media could serve as a replacement for stereotypic behavior; on the other hand, previous literature has suggested that a reduction of stereotypic behavior is due to the use of a technology-delivered self-monitoring program.

At the same time, this research identified some other behavioral issues related to 'learning how to learn' that are also reflected in previous literature. In Part Two, some students were observed to be distracted (Mazurek & Engelhardt, 2013). In Part Three, a teacher commented that *"electronic devices may make students inattentive if watch video for too long time"*. Also, some students engaged in oppositional behaviors such as non-compliance and temper tantrums that were associated with the use of gadgets (Falcomata et al., 2013; Hanley et al., 2014). As demonstrated in Chapter Seven, a teacher in Part Three reported an instance where a disruptive behavior started out mild and then built to a more intense level during the use of screen-based media: *"They might scream, say 'No' quite loudly, crying, and then that will lead to an episode which can last for a period of time, which means that the student cannot get back to work until he's calm"*.

Social and communication. The results of this research are consistent with previous studies that demonstrate electronic devices are effective in increasing communication skills for individuals with autism (Alzrayer et al., 2014), especially verbal requesting (Chan et al.,

2014; King et al., 2014; Sigafoos et al., 2013). In Part One, one teacher reported that they taught the students to *"voice out 'I want to play longer', 'I want the iPad back'"*. In Part Two, the students were observed to verbally express their desire to use gadgets with statements like, *"I want iPad please"* and *"I want to play longer"*. However, in this research, the students made requests because they wanted to use the gadgets; previous literature suggests that the students used the applications on the gadgets to make requests for other toys. This difference is possibly because the teachers in the observed classes in the present research did not introduce communication-related mobile applications to the students, as all the students were able to use some level of speech to communicate with others.

There are concerns that technology may reduce social communication and interaction. In Part Four, a parent shared, *"The more my child spent time on his digital devices, the less interactions he would have with us or his peers"*. As Parsons and Mitchell (2002) argue, technology may make it more difficult for individuals with autism to want to interact with other people in the 'real world'.

Effectiveness. Previous research has shown that technology can enhance the effectiveness of ABA for students with autism in terms of behaviors, socialization and communication. In the present research, similar benefits were observed in Part Two, and the teachers described more positive impacts in Part Three. However, some parents in Part Four questioned the effectiveness of technology use for children with autism. A parent commented, "*Whether it [screen-based media] is really helping my child to learn … is also what I wish to know and if can, ascertain*". Even though this study showed some positive impacts of technology use among students with autism, there are many possible factors affecting students' performance and behavior, such as instructional formats, curriculum, and peer influence. The functional relationship between technology and behavior will be discussed further after the following section in this chapter.

Attitudes to Technology Use

Previous literature has indicated that both parents and professionals hold positive attitudes toward the use of screen-based media (Clark et al., 2015; Fletcher-Watson et al., 2015). However, the present research shows a noticeable range of perspectives toward technology use from the teachers, students, parents, and myself as the researcher. The teachers reported more benefits, while the researcher observed more issues. The teachers identified many effective management strategies, while the parents were uncertain about how to manage the problems associated with technology use. The teachers and parents restricted the accessibility of electronic devices, while the students requested to use the gadgets more. The possible reasons contributing to the different views regarding technology use among students with autism will be discussed below.

Teachers. The teachers from Aoi Pui School reported more benefits of technology use and they identified more effective management strategies, possibly because they were professionally trained to utilize different tools to teach students to behave well and to acquire skills effectively (Au et al., 2015). Furthermore, they conducted the lessons by following individualized education plans developed by supervisors based on the students' needs. The teachers are expected to report student performance to their supervisors and the parents regularly (Aoi Pui School, 2020). Another point to note is that there is tremendous pressure on practitioners today to rush through programs in autism treatment. Teachers can become preoccupied with the task of making the students "look good" (Leaf et al., 2018). As the teachers' perspectives could be driven by progress and making the students look good, they may have shared more positive notes towards their teaching.

Parents. In Part Four, the parents reported being uncertain about how to manage issues associated with technology use. There are a few possible reasons for this uncertainty. First, parents may have priorities other than managing their children's issues associated with

technology use; for example, they may be more focused on improving their child's relationships, academic performance, and wellbeing. Second, changing behaviors is difficult. The parents may not have the knowledge and skills to manage behavior. It is especially challenging for the parents as they are emotionally attached to their child, and they may have to deal with issues anywhere at any time. Third, evaluating effectiveness is complicated. Objective evaluation of whether a strategy is effective or not in managing an issue is difficult when there are many things happening at the same time in a natural environment. Other factors that could affect objective evaluation include an absent or inconsistent measurement system, inadequate observer training, and unintended influences on observers such as observer expectations, observer reactivity, and observer bias (Cooper et al., 2014).

Students. The students from Aoi Pui School were very keen to use screen-based media. Throughout the observation in Part Two, many students asked to play on the tablet or desktop computer for longer. For example, one student frequently said, *"I want iPad"* when he saw the teacher using the iPad. Other students often requested to play on the desktop computer for a longer time when the teacher asked them to stop playing during a reinforcement break. One student even approached the teacher to negotiate why he should have more time to play with the electronic device. There are many possible reasons why the students demonstrated their desire to play with the gadgets. One apparent reason is that it is fun. The gadgets allowed the students to access millions of media and games. They provide ongoing stimulation, which is entertaining to the students. Another possible reason is that children with autism have an insistence on sameness (American Psychiatric Association, 2013). In turn, we may suggest that the students were able to connect with electronic devices easily because the gadgets are highly predictable. Unlike interacting with human beings, interacting with electronic devices produces very predictable outcomes almost all the time. Moreover, most students were able to use gadgets independently. They did not need to worry

about how to deal with other people while using screen-based media. At the same time, it is possible that students preferred playing gadgets over attending certain lessons with teachers, as on many occasions the students requested to play with the devices when they were about to attend a lesson or during lesson time.

Researcher reflections. As a researcher, I observed more issues with using screen-based media among students with autism than benefits. This is possibly due to my work experience and history. I have been providing interventions for individuals with autism for over 20 years based on ABA principles evolved from the UCLA Young Autism Project. One of my core limitations in understanding behaviors is that I previously viewed behaviors as problematic based on their functions, shapes and impacts on people and the external environment, without considering how these behaviors relate to the minds and mental processes of autistic people. Moreover, as a trainer and consultant, I have been assigned to educate practitioners and parents to help our students with autism to improve. One of my primary duties is to identify problems and suggest solutions. I have felt a sense of satisfaction and reward from solving problems by changing behaviors effectively. In my clinical practice, I am habitually looking for problems, considering potential risk factors—such as how behaviors negatively affect an individual's wellbeing, learning, socialization, and how they may disrupt the surrounding environment—and working very hard to solve them. Even though I do not see autism as a problem to be solved, I do see many behaviors that should be changed. For example, I often see stereotypic behaviors as problematic because they affect learning and are stigmatizing (Leaf et al., 1999). Individuals with autism may also consider these behaviors stigmatizing because the condition evokes punitive or negative responses in people (Gray, 1993). The training I have received has encouraged the belief that self-stimulation is a preference instead of a need, and it should be modified. It was not until conducting this research that I realized that I have not been sufficiently critical of many of

my professional beliefs. Thanks to this research, I have been able to actively and objectively gather information from our students with autism, teachers, parents, my research supervisor, and co-workers, which has allowed me to see my beliefs and work from different angles. For example, behavior problems are stigmatizing because there is a lack of public knowledge on autism (Harrison & Gill, 2010). The views of individuals with autism should be listened with respect: the term “autistic” is preferred by most autistic adults, parents and friends (Kenny et al., 2016), and stereotypic behavior can be seen as a soothing strategy in response to sensory issues (Grandin, 2004).

Relationship between Technology and Behavior

The objective of this research is to investigate why and how the teachers in Aoi Pui School use ABA-based strategies and technology among students with autism. In particular, it aimed at identifying the benefits and issues related to the use of screen-based media on students’ learning and behavior. Even though this research has found some behaviors related to technology use, the correlation and functional relation between them cannot be demonstrated. Correlation refers to a relationship whereby the relative probability that an event will occur based on the occurrence of the other event can be predicted. Two events consistently covary with each other can be found through repeated observations (Cooper et al., 2014). A functional relation can be demonstrated when specific manipulations of an event can reliably produce a specific change in another event, and that the change was unlikely to be the result of other factors through a well-controlled experiment (Johnston & Pennypacker, 2010). This study can demonstrate neither a correlation nor functional relation between technology use and behavior for several reasons, as will be discussed in the following sections.

Relationship between technology and behavior observed by teachers. It is not uncommon to hear that many professionals and parents are dubious about using screen-based

media for children with autism. In my 20 years of clinical experience, I have heard some medical professionals and teachers comment that they do not advocate technology for students with autism, especially younger children. Similar comments were also found in this research: for example, a teacher in Part One expressed, *"My students are more in need to learn social communication, I would like to not just using the electronic devices"*.

During the interviews, almost all the school teachers talked about issues related to the use of gadgets. However, many teachers claimed that the issues were also observed when the electronic devices were not in use. They were not sure if there was a clear functional relationship between the screen-based media used and the issues identified. Moreover, during classroom observations, the issues were seen to arise both with and without the use of technology. For example, a student engaged in stereotypic behaviors in the form of hand-flapping and body rocking when he was playing typing games on a desktop. The same behaviors also occurred when he was working on a paper worksheet. Another student shouted 'No' and refused to follow the verbal instruction issued by a teacher to change the activity they were engaged in on a desktop. He also whined and displayed non-compliance after the teacher gave him corrective feedback upon an incorrect response to a verbal demand when screen-based media was not being used. A teacher reported that one student exhibited a temper tantrum upon the termination of the use of a tablet. However, the same challenging behaviors were also observed when the teacher asked him to stop drawing with a marker and paper. Another teacher reported that one student was distracted when another classmate was working on a desktop. Yet the same student was also distracted when another classmate was eating a banana.

At the same time, there is no doubt that some challenging behaviors were the result of repeated access to age-inappropriate content via video clips and websites. For instance, it was

reported that one student repeatedly talked about natural disasters. However, his teacher also noted that the information the student scripted was also found in books.

Relationship between technology and behavior described by parents. I have met parents who have told me that they are totally fine with their children using technology in their everyday lives. On the other hand, some parents prefer their children not to watch television or play gadgets as they spent too much time with them. A parent in Part Four reported that, *"Screen-based media can help them [the children] sometimes but mostly make them lazy"*. However, the parents I have spoken to nevertheless did not limit their children's access to screen-based media due to various practical reasons: some family members did not mind giving them the gadgets, parents were often too busy to interact with their children through non-digital activities, and the devices were useful to keep the children busy and calm in the community. Similar conflicting views and dilemmas were found in Part Four. Some parents reported more positive views on using technology with their children at home, whereas some parents had more negative experiences with gadgets. Some parents were uncertain about the benefits and issues of using technology with their children at home.

Other variables identified by the researcher. In the course of my research, I realized that the functional relation between technology use and the students' behaviors was unclear because many other possible variables were affecting the students' progress and problems. Based on my clinical experiences in working with autistic children, these variables include instructional formats, curricula, peer influence, history of reinforcement, diagnostic features, students' cognitive abilities, teachers' expertise, management consistency, and parenting factors.

Progressive ABA

Different individuals with autism present similar diagnostic features in terms of social and behavioral characteristics. However, every student with autism is unique and has their

own strengths, weaknesses, and characteristics. Educational support for autistic people should be individualized, based on evidence, and structured yet flexible (Leaf et al., 2015). Previous research has shown that Applied Behavior Analysis (ABA) is an evidence-based practice for students with autism (Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Riechow et al., 2010; Roane et al., 2016). However, ABA is rejected by some parents, schools, and professionals: according to Leaf, McEachin, and Taubman (2009), the possible reasons behind this educational resistance include the beliefs that ABA is ineffective, outdated, disrespectful of students, experimental, and punitive, that it has a limited age range, and that the results do not hold up over time (Leaf et al., 2018). Kupferstein (2018) claimed that children and adults with autism exposed to ABA had an increased chance of suffering from post-traumatic stress symptoms (PTSS). Kupferstein followed this study up by using a mixed method thematic analysis to review the long-term impact of ABA. The results showed that individuals with autism who received no intervention compared to those who received an ABA intervention had a 59 percent lower likelihood of meeting the PTSS criteria. It was further reported that some people with autism and their caregivers discontinued ABA because they felt their quality of life could be enhanced more through eclectic approaches such as psychotherapy, mental health-focused and other interventions (Kupferstein, 2019).

The group “Autistics Against ABA” (2017) explicitly states on their website that “the autistic community does not support applied behavior analysis.” Anna Williams, an adult with autism, declared that ABA suppresses competence and autonomy in people with autism. Anna wrote that the voice of the autism community was often unheard and ignored (Williams, 2018). Ari Daniel Ne’eman, an adult with autism who co-founded the Autistic Self Advocacy Network, criticized the use of aversive strategies such as pain and sensory punishments to suppress challenging behaviors in the field of ABA over a focus on teaching useful skills (Ne’eman, 2010).

When the Local Education Authorities (LEA) decided not to fund ABA programs in the UK, Autism Partnership—an international ABA service provider for families of individuals with autism—stated that "the reputation of ABA in the UK and the surrounding countries [is] nearly ruined" (Leaf, Leaf & McEachin, 2018, p. 76). This decision was taken as studies showed that most students who received ABA made limited progress. In particular, a meta-analysis review suggested that ABA did not have better outcomes than standard care for children with autism (Spreckley & Boyd, 2009). Leaf et al. (2018) claimed that this disappointing outcome was due to the behaviorists, who were mostly inexperienced and had inadequate training. Their approach was "extremely protocol-driven" (p. 76). To rebuild the reputation of ABA, it took many years of work to help professionals and parents to learn that "not all ABA is alike", and it can be "extremely effective but it takes extensive training and expert supervision. Quality ABA requires a great skill set, innovatively implemented, using expert clinical judgment" (Leaf, Leaf & McEachin, 2018, p. 77). Aoi Pui School adopted the progressive ABA approach advocated by Autism Partnership. The components of this approach included having more than one procedure, instructional arrangement, reinforcement, functional analysis of aberrant behavior, discrete trial teaching, data collection, curricula, applied significance, and staff training (Leaf et al., 2015). These elements will be discussed below in relation to the use of screen-based media in Aoi Pui School in order to demonstrate ABA can be effective for students with autism.

Not just one procedure. The teachers in Aoi Pui School implemented a wide variety of procedures based on the theories and principles of ABA (Baer et al., 1968). A comprehensive treatment approach comprised of operant and respondent-based procedures (Harris & Handleman, 2000; Lovaas, 1987; Sallows & Graupner, 2005) was described by the teachers and observed in the classrooms throughout the research. For example, in Part Two the teachers taught film-making skills and building blocks through video modeling (Charlop-

Christy et al., 2000) and role-playing (Leaf et al., 2012). Furthermore, the classroom routines were observed to be task-analyzed into teachable steps (Parker & Kamps, 2011) and combined with prompting procedures (Leaf et al., 2016), including a flexible use of physical, gestural, demonstration, visual, and observational prompts. At the same time, chaining procedures (Jerome et al., 2007) were used, which teach skills from the first step, from the last step, or all the steps at one time based on the student's needs. For example, in Part Two the teachers taught the students addition and subtraction in a step-by-step process with visual aids shown on a projector screen. To manage challenging behaviors, the teachers assessed the possible functions of the behaviors (Iwata et al., 1994) and combined differential reinforcement procedures with various punishment procedures (Lerman & Vorndran, 2002). For instance, they would sometimes remove a gadget, or have the students repeat a practice as a penalty upon giving an incorrect response. The teachers also use respondent procedures such as systematic desensitization (Koegel et al., 2004) to teach the students to overcome different stressors and to stay calm. For example, in Part One, a teacher described how she taught a student not to get frustrated upon the removal of a highly preferred reinforcement by repeatedly removing his iPad.

Instructional arrangement. In Part Two, the teachers in Aoi Pui School were observed to implement a variety of different instructional formats with the use of technology based on ABA principles, ranging from one-to-one instruction to one-to-eight instruction. Even though a one-on-one instructional format provides students with sufficient adult attention to meet individualized educational goals, group instruction is essential for students with autism because it allows for observational learning (Charlop et al., 1983). Furthermore, it can lead to the acquisition of social (Langeson et al., 2014), language, and academic skills (Ledford & Wehby, 2015).

Reinforcement. The use of reinforcement is a core component of ABA. Reinforcement motivates learning and is the backbone of teaching. Many studies have evaluated the effectiveness of using reinforcement to increase and to maintain desired behaviors (Cooper et al., 2014). Instead of using food as rewards, it was observed in Part Three that the teachers in Aoi Pui School use different types of reinforcement including screen-based media, recognition from teachers and peers, play activities, unique opportunities, and privileges. Part Two demonstrated how various forms of token economies were used in the classrooms including the use of stickers, points, meters, and tick systems (Appendix H). The schedule of reinforcement varied from continuous to intermittent and from a predictable to an unexpected schedule based on the needs of the students. In Part One, the teachers reported having made constant efforts to develop new reinforcements on gadgets and ongoing evaluations regarding the effectiveness of those reinforcements.

Functional analysis. A hallmark of quality ABA programs is the use of functional analysis (Iwata et al., 1994) to assess the possible functions of challenging behavior. Functional analysis helps practitioners to identify interventions for students to learn socially significant skills as replacements for aberrant behaviors. However, most research on functional analysis has taken place in an analog or experimental setting such as a hospital (Leaf et al., 2015). Such research may therefore not provide an evaluation of students within a natural environment (Hanley et al., 2003). In Part Three, the teachers in Aoi Pui School reported looking at the functions of challenging behaviors using descriptive assessments through direct observations in the classrooms, and then teaching the skills that met the results of those assessments. For example, in Part One the teachers developed students' tolerance for increasing effort and duration as the teachers believed shouting and walking away served the function of avoidance and frustration release. In Part Two, the teachers taught computer games as a replacement for self-stimulatory behaviors. Furthermore, the teachers taught

social communication skills based on the hypothesis that students engaged in challenging behaviors to seek attention and control.

Discrete trial teaching. One of the most commonly used teaching methodologies in the field of ABA is discrete trial teaching (Ghezzi, 2007). This method was derived from learning theory, first described by Lovaas et al. (1973) as an active learning and effective teaching procedure. The technique consists of repeated teaching of small units with the use of reinforcement, prompting, and prompt fading if necessary. The strategy can be used for all ages and populations (Leaf & McEachin, 1999), and was intended to be implemented flexibly (Leaf, 2015). Unfortunately, it has become protocol-driven, and many therapists use it in a very rigid manner, such as by using simple instructions (Green, 2001) and counterbalancing (Grow et al., 2011). In Part Two, the teachers in Aoi Pui School were observed to use discrete trial teaching with technology in a structured yet flexible manner. The teachers varied the complexity of verbal instructions and feedback based on students' ages and skill levels. The teachers implemented a flexible prompt fading procedure (Leaf at al., 2016) that involved the use of different prompt types based on their in-the-moment assessment of the students' behaviors and performance. The teachers used discrete trial teaching across different instructional formats, sometimes in a less distracting environment, and sometimes in a more chaotic learning environment.

Data collection. ABA relies on objective data gathered through the measurement of observable events (Baer et al., 1968). Data can help teachers to identify students’ needs, examine treatment procedures, evaluate treatment effectiveness, and provide guidance for making clinical decisions (Leaf et al., 2008). Instead of using a standard data collection system, multiple methods and sources of measurement systems can be used (Leaf et al., 2013). The teachers in Aoi Pui School struck a balance between teaching students and collecting information by taking time sampling data. In Part Two, the ABA supervisor and

lead teachers were observed to collect data through occasionally taking videos and reviewing them on a desktop computer during class time (Appendix H). Different data collection procedures were used, including probe trial data, trial-by-trial data (Cummings & Carr, 2009), and estimation data (Leaf et al., 2013).

Applied significance. ABA is a science in which the principles of behavior are applied to improve socially significant behaviors in clients (Cooper et al., 2014). ABA practitioners should focus on the selection of practical procedures with meaningful purpose, process, and outcomes (Leaf et al., 2015). In this research, the teachers in Aoi Pui School were observed to target 'learning how to learn' skills such as compliance, meaningful attending, exerting effort, being calm and observational learning through teaching with technology. The teachers adopted a holistic curriculum that included communication, play and leisure skills, social skills, and academics. They were observed to use screen-based media to teach a variety of curricula in this study. The teaching goals were developed based on students' preferences, readiness, strengths, weaknesses, and functionality. Other forms of support for enhancing program effectiveness included parental involvement, pre-vocational training, after-school programs at home, and shadow teacher services ("Aoi Pui School", n.d.).

Staff training. Quality ABA-based programs require the teacher to apply their knowledge and the principles of behavior, and to implement teaching procedures delicately (Leaf et al., 2015) with in-the-moment analysis (Soluaga et al., 2008), critical thinking (Green, 2010), and flexibility (Leaf, 2015). In Part Two, the teachers in Aoi Pui School were observed to work closely with senior staff, including ABA supervisors and consultants. In Part Three, they reported their regular communication with the supervisors and lead teachers regarding the use of technology for their students in the classes. "Aoi Pui School" (n.d.) stated that their teachers have to undergo intensive training in ABA for 160 hours before their

service, over 450 hours of supervision in their first year, and ongoing training after that. The training covers four broad domains: 1) Effective teaching strategies such as discrete trial teaching, shaping, task analysis, and group instructional learning; 2) Behavior management procedures such as differential reinforcement, functional analysis, and various reactive and proactive strategies; 3) The development of curricula that include teaching language, play, social skills, self-help skills, pre-academics, and academics; and 4) Professionalism, including issues around ethical conduct, clinical sensitivity, and working with parents (Au et al., 2015).

Limitations of Work Presented in this Research

This research investigated the benefits, issues, and management of screen-based media for students with autism in Aoi Pui School through interviews, observations, and a questionnaire with teachers, students and parents. However, it has some limitations: it has a small sample size; students' opinions were not heard; parents' perspectives were derived only from a self-report questionnaire; limited types of technology were investigated; and there is insufficient information on how technology was being used.

Small sample size. Six teachers in total were interviewed across both Part One and Part Three. Twelve students were observed in Part Two. Eight parents completed the questionnaires in Part Four. By studying only one school, the researcher aimed to achieve a more in-depth understanding of the subject matter (Yin, 2018). Although a small sample size has limited representation and generalizability, and although the results of this research only reflect the situation of a very unique and specific context, the findings may lead to greater insight into "how' and "why" technology is managed among students with autism. Future studies should replicate the same phenomenon in different conditions to generalize results to students with autism in other schools.

Students did not get a chance to voice their opinion. I did not interview the students in this study because their receptive and expressive language was limited. Instead, their behaviors related to the use of screen-based media were observed in Part Two. Furthermore, the teachers described how the students used technology in Part One and Part Three, and this was also described by the parents in Part Four. Even though the students in this research were children and they may not have had the capacity to fully express their opinions about learning through technology, their voices matter. The United Nation Convention on the Rights of the Child (CRC) states that children shall have the right to express themselves (Article 19). Individuals with autism have the right and perhaps the duty to speak for themselves (Nicolaidis et al., 2018). A peer-reviewed journal, *Autism in Adulthood*, includes adults with autism as editorial members, peer-reviewers and readers. In Hong Kong, a group of adults with autism organized and hosted a radio program titled "A Child? A Guy!" to voice out their perspectives about autism related to different topics such as education placement, legal concerns, career development and romantic relationships. The program was broadcast on Radio Television Hong Kong (RTHK) in 2018 and 2019. In the program, the organizers interviewed people from different backgrounds, including parents, lawyers, teachers and medical professionals. I was honored to be invited as an organizing committee member and the host of the program. Future research should include the voices of individuals with autism, not only to increase the validity of the research but more importantly to respect the rights of the autism community.

Parents' perspectives were derived only from a self-report questionnaire. I obtained information from teachers, students and parents to achieve data triangulation. In Part Four, a self-administered questionnaire was used to gather parents' perspectives on how their children used screen-based media at home. Using questionnaires for data collection is convenient and inexpensive. Unlike face-to-face interviews, there is no time constraint and

the respondents can maintain their anonymity. However, the data collected from self-administered questionnaires may not be accurate since it relied solely on self-reports from the parents. It is difficult for me to detect ambiguities and any misunderstandings of the questions (Robson, 2011). In this research, some items were left unanswered by the respondents. Some parents put additional notes for some questions while other parents only checked the boxes without giving any written remarks. Given the small number of participants in this study, future research should collect data from parents via interviews and questionnaires according to the parents' preferences.

Limited types of technology were investigated. This research investigated how teachers used desktop computers, projectors, tablets and smartphones among students with autism in the classroom because these electronic devices were available in Aoi Pui School. However, many other technologies were not investigated in this research, including robots, artificial intelligence, virtual reality, 3D printers, audio devices, and popular software such as Siri, Facetime, Google Assistant and Zoom. Future research should include schools where teachers use a different variety of technologies.

Insufficient information on how technology was being used. This research did not look in detail at the content of technology was being used to target the needs of the students with autism in Aoi Pui School. For example, I developed a mobile application called 'Token Economy'. On this app, teachers can provide different forms of tokens on an iPad upon the occurrence of target desirable behaviors to motivate students with autism to behave well (for instance to keep quiet, keep their hands still, and pay attention to the teacher). Since students' performance and behaviors are affected by the objectives and procedures of teaching strategies, future research should investigate how technology should be used to positively impact the learning of students with autism.

All in all, future research should include more participants from more different schools to investigate the functional relation between technology and learning, and to identify more specific details on how technology can be used among students with autism to positive effect.

Conclusion

I hope this study contribute to the advancement of knowledge in using progressive ABA for students with autism in several aspects—First, technology has become an important part of progressive ABA. Technology is included in ABA-based interventions as it is one of the many tools that can help students with autism to learn effectively (Artoni et al., 2018). This study showed that screen-based media is not a replacement for teachers and traditional teaching materials. It is a supplementary tool that has both positive and negative impacts on students, depending on how it is used, managed and how we see it. Second, traditional ABA has been seen as robotic, protocol driven, and without considering the feelings and mental process of autistic individuals. This study showed that ABA-based intervention can be conducted in a structured yet flexible and natural manners. Instead of relying on food as a primary source of motivation, teachers can motivate students through the use of naturally occurring reinforcement such as classroom activities, social interaction and screen-based media. Progressive ABA lessons can be conducted not only in individual format, but also in group and school settings. Teaching materials are not just limited to flash cards, teachers can use a combination of different traditional tools and technology for lessons. ABA is not just one procedure, it should be applied progressively through a combination of effective strategies, activities, instructional formats, and media (Leaf et al., 2015). Third, it is vital to collaborate with parents and to understand the individual characteristics and needs of each autistic student. Curriculum should be designed to focus on the whole child and to build strong learning foundations such as paying attention, following classroom rules and coping

frustrations so that the students can learn other important skills of talking, playing and enjoying friends.

All in all, technology is one of the many tools that can enhance ABA-based teaching when teachers apply ABA principles and knowledge progressively with a great deal of clinical sensitivity, flexibility, critical thinking, delicacy and understanding of the students' characteristics and needs.

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Appendix A: Teacher Consent Form

FUNG Yiu Man, Raymond is enrolled in the Doctor of Education program at the University of Bristol, UK. As part of my doctoral degree, I am conducting dissertation research on how the teachers manage technology use for students with autism in Aoi Pui School.

I would like to ask you to be part of my research project.

Why am I doing the research?
I am interested in how teachers and students use technology. There will be group interviews with teachers, classroom observations, individual interviews with teachers, and questionnaire for parents.

What will happen in the research?
The project will study how the teachers manage technology use for their students in the classroom. Two teachers as a focus group will be interviewed. I will then observe some lessons, including group lessons and individual lessons conducted by each teacher for each class. Each lesson will be observed for 30-45 minutes. After the observations, I will conduct an individual interview with the teachers separately. During the interviews and the observations, I will collect data only on how the teachers manage technology use in the class. No sensitive information related to the teachers and the students will be collected in this study. The parents of the students from the observed classroom will be invited to fill out a questionnaire about how the students use technology at home.

What are the benefits of the research?
The study can provide additional information and analysis regarding the behavior of the students, the benefits and risks related to the use of technology in the classroom and the intervention procedures to manage them. Also, it provides insight into the use of technology in supporting students with autism.

What are the risks of the research?
The teachers may feel stressed and uncomfortable because their behaviors are being observed by me, who is the performance evaluator of Autism Partnership. This study serves as my dissertation for the Doctor of Education program at the University of Bristol. It is not for performance evaluation of the teachers.

Also, the students may get distracted. To minimize the stress of the participants, I will explain to the participants that the observation focuses on how the teachers manage technology use for their students, but not the performance of the teachers. I will stay in the corner of the room during observation. To minimize the distraction to the students, I will not interact with them during the observation.

What will happen to my data?
All information obtained in connection with this project is confidential, and no identifying information will be reported.

What if I have questions or a problem?
If you have any questions, you can contact me at yf16443@bristol.ac.uk. If you have any problems, you can speak to me or you can choose to contact my supervisor, Dr. Felicity Sedgewick, the University of Bristol at felicity.sedgewick@bristol.ac.uk.

Do I have to take part?
Participation is voluntary. Your decision to participate or not will not affect your current or future relationship with Aoi Pui School, University of Bristol or me. If you decide to participate, you are free to withdraw at any time without affecting your relationship with Aoi Pui School, University of Bristol or me.

Your signature indicates that you have read the information provided above and have decided to participate. You have had the opportunity to ask, and you have received the answer to all the question you had regarding the study. You may withdraw from the study at any time without affecting our relationship after signing this form. You understand that if you have any additional questions about your rights as a research participant, you may email FUNG Yiu Man, Raymond at yf16443@bristol.ac.uk or call 25263812.

Signature _____ Date _____

Researcher Signature _____ Date _____

Researcher Contact Information
FUNG Yiu-Man, Raymond
7/F 633 King’s Road, Hong Kong
yf16443@bristol.ac.uk
25263812

Appendix B: Parent Consent Form

FUNG Yiu Man, Raymond is enrolled in the Doctor of Education program at the University of Bristol, UK. As part of my doctoral degree, I am conducting dissertation research on how the teachers manage technology use for students with autism in Aoi Pui School.

I would like to ask your son/daughter to be part of my research project.

Why am I doing the research?
I am interested in how teachers and students use technology. There will be group interviews with teachers, classroom observations, individual interviews with teachers, and questionnaire for parents.

What will happen in the research?
The project will study how the teachers manage technology use for their students in the classroom. Only four teachers from two classes will be interviewed as a focus group so that more in-depth understanding can be achieved. I will then observe some lessons, including group lessons and individual lessons conducted by each teacher for each class. Each lesson will be observed for 30-45 minutes. After the observations, I will conduct an individual interview with the teachers separately. During the interviews and the observations, I will collect data only on how the teachers manage technology use in the class. No sensitive information related to the teachers and the students will be collected in this study. The parents of the students from the observed classroom will be invited to fill out a questionnaire about how the students use technology at home.

What are the benefits of the research?
The study can provide additional information and analysis regarding the behavior of the students, the benefits and risks related to the use of technology in the classroom and the intervention procedures to manage them. Also, it provides insight into the use of technology in supporting students with autism.

What are the risks of the research?
Your son/daughter may be distracted because I am observing his behaviors. To minimize the distraction, I will stay in the corner of the room and will not interact with your son/daughter during observation.

What will happen to my data?
All information obtained in connection with this project is confidential, and no identifying information will be reported.

What if I have questions or a problem?
If you have any questions, you can contact me at yf16443@bristol.ac.uk. If you have any problems, you can speak to me or you can choose to contact my supervisor, Dr. Felicity Sedgewick, the University of Bristol at felicity.sedgewick@bristol.ac.uk.

Do I have to take part?

Participation is voluntary. Your decision to allow your son/daughter to participate in this project or not will not affect your current or future relationship with the University of Bristol, Aoi Pui School or me. If you decided to participate, you are free to withdraw at any time without affecting your relationship with the University of Bristol, Aoi Pui School or me.

Your signature indicates that you have read the information provided above and have decided to participate. You have had the opportunity to ask, and you have received the answer to all the questions you had regarding the study. You may withdraw from the study at any time without affecting our relationship after signing this form. You understand that if you have any additional questions about your rights as a research participant, you may email FUNG Yiu Man, Raymond at yf16443@bristol.ac.uk or call 25263812.

Signature _____ Date _____

Researcher Signature _____ Date _____

Researcher Contact Information
FUNG Yiu-Man, Raymond
7/F 633 King's Road, Hong Kong
yf16443@bristol.ac.uk
25263812

Appendix C: Student Consent Form

FUNG Yiu Man, Raymond is doing a research project for my homework on how teachers and students use gadget in classroom.

I would like to ask you to be part of my project.

Why am I doing the research?
I am interested in how you use gadgets, what good things and what problems can happen, and how teachers manage problems when they happen. There will be classroom observations, interviews with teachers, and questionnaire for parents.

What will happen in the research?
I will sit in your classroom and watch a few lessons for 30-45 minutes each. After the observations, I will talk to the teachers. We won't talk about you personally, but about the class in general.

What are the benefits of the research?
The project can help teachers to understand gadget use in the classroom better so we can help you have a better time.

What are the risks of the research?
You might get distracted. I will stay in the corner of the room and will not talk to you while I am there.

What will happen to my data?
All information obtained will be kept to myself and my supervisor. Nothing with your name on it will be shown to anyone else.

What if I have questions or a problem?
If you have any questions, you can contact me at yf16443@bristol.ac.uk. or my supervisor, Dr. Felicity Sedgewick, the University of Bristol at felicity.sedgewick@bristol.ac.uk.

Do I have to take part?
You can say yes or no to the invitation. If you say no, I will not write down anything about your behavior when I visit your classroom.

Contact Information
FUNG Yiu-Man, Raymond
7/F 633 King's Road, Hong Kong
yf16443@bristol.ac.uk
25263812

Progressive ABA, Autism and Technology

By writing your name below, you agree that:

I understand what will happen in the research ☐

I understand that it is up to me whether I take part in the research ☐

I understand I can stop taking part at any time ☐

I understand I can ask for anything about me to be taken out later ☐

I understand nothing with my name on it will be written down anywhere public ☐

Signature _____ Date_____

Researcher Signature _____ Date _____

Appendix D: Part One: Focus-group Interview Questions

Today is _____. The time is _____. The venue is _____.

I am Raymond Fung. I am currently an EdD student at the University of Bristol. I am conducting a research on how teachers manage the use of technology among students with autism at Aoi Pui School. I have already got the consent from you and the principal to conduct this study. My role here is a student researcher. This study is not for performance evaluation. It serves as my dissertation for the EdD.

I appreciate your acceptance of my invitation to attend this 1-hour interview. With your consent, this interview will be conducted in English and on a voluntary basis. I will use my iPad and iPhone to record our conversation for my reference. After the interview, you may approach me to access, amend or delete any or all of the data provided in this interview. All the information collected will be used exclusively for the academic purpose of this study, and will not be disclosed to any other parties except my dissertation supervisor without your permission. If you wish to discontinue during the interview, please feel free to let me know at any time.

I will ask different questions regarding how you manage the use of technology among your students in the class. I would like to encourage you two to interact and to discuss with each other during the interview.

If you have no questions, let's begin our interview now. Shall we?

Warm-up questions/ Background information

1. How many students are there in your class? How old are they? What language do they use?
2. What is their functioning level?
3. Do you use technology in the class? How many gadgets do you have?

4. How often do you use technology with your students in the class?

Benefits

1. Why do you use/not use technology with your student in the class?
2. Can you share one positive experience using technology with your student?
3. How does technology help your students in the class?
4. What are the objectives you want to achieve through the use of technology with your students?
5. How do you achieve the objectives? Please describe the procedures.

Issues

1. Can you share one negative experience using technology with your student?
2. What other issues did you find when you use technology with your students in the class?
3. What behavior problems do you see related to the use of technology in the class?

Management

1. How do you manage the issue related to the technology use with your students? Please describe the procedures.
2. Any other possible intervention options that you have considered?
3. Why did you select the strategies to manage the issue?

Appendix E: Part Two: Classroom Observation List

Direct informal observation will be conducted to record the following behaviors and any other behaviors related to the use of screen-based media in the classroom. Observer will sit at the back of the classroom without any interaction with the teacher and students. The following information will be recorded:

Number

The number of times the teacher used the screen-based media with student, that is, 1 as the 1st time, 2 as the 2nd time and so on.

Teacher

Teacher's instruction, that is, what did the teacher do and say when he/she used the screen-based media with student.

Student

Student's response, that is, what did the student do and say right after teacher's instruction.

Content

Content on the screen-based media, for example, photo/video, educational, app, timer, game, social media, utilities.

Benefits

Skill acquisition if any, for example, describing, communication, sight words, math's, follow procedures, play skills, leisure skills.

Behavior enhancement. For example, compliant, being fast, complete task independently.

Attending. That is, looking at teacher/student when hold up the screen-based media

Verbal communication. That is, talking to other student/ teacher with appropriate tone of voice, for example, initiate statement/question verbally, respond to statement/question verbally.

Social interaction. For example, respond to initiation, initiate and maintain play interaction, wait, turn taking, rock paper scissors, helping, play alternative, compromise.

Social awareness. For example, aware the presence of other, identify/ discriminate/ understand others feeling, follow social rules, gestures.

Issues

Challenging behavior. If any, for example, disruptive behavior such as temper tantrums, grabbing, quarrel, swiping, snatching, pushing, blocking, non-compliant, crying, complaining, turning away, shoving.

Behaviors that affect learning. Such as inattention (looking away), self-stimulation (scripting).

Other challenging behaviors. Such as do not choose other activities or toys, spend to much time siting down (less exercise).

Dimension

Frequency. That is, the number of instances of the challenging behavior.

Duration. That is, how long did the challenging behavior last.

Intensity. That is, the magnitude of the challenging behavior.

Before

What happened immediately before the challenging behavior, for example, internet not working, termination of the screen-based media, other student is playing screen-based media, timer goes off, other student snatches the screen-based media.

After

What happened immediately after the challenging behavior, for example, get the screen-based media, more time to play screen-based media, removal of screen-based media , corrective feedback from teacher, time-out from positive reinforcement, physical blocking, being separated.

Managed by student

How student managed the challenging behavior, for example, wait (sit and keep hands nicely), communication, tolerance, keep personal space, stay calm (emotional control), taking turns, play alternatives, Rock Paper Scissors, report to teacher, self-evaluation, compromise, voting.

Managed by teacher

How teacher managed the challenging behavior, for example, priming, termination of screen-based media, turn down volume, limit availability, use projector, distract the student, separate students, tokens for absence of the disruptive behaviors, be a good friend, social awareness, develop interests, Teaching Interactions Procedure, discrimination training, teach first come first serve, perspective taking.

Appendix F: Part Three: Individual Interview Questions

Today is _____. The time is _____. The venue is _____.

Good to see you again. As you know, I am currently a doctoral student at the University of Bristol. I am conducting a research on how teachers manage the use of screen-based media among students with autism at Aoi Pui School. I have already got the consent from you and the principal to conduct this study. My role here is a student researcher, not a consultant. This study is not a performance evaluation. It serves as my dissertation for the EdD.

I appreciate your acceptance of my invitation to attend this 1-hour interview. With your consent, this interview will be conducted in English and on a voluntary basis. I will use my iPad and iPhone to record our conversation. After the interview, you may approach me to access, amend or delete any or all of the data provided in this interview. All the information collected will be used exclusively for the academic purpose of this study. Some of the data will be shared to my dissertation supervisor. Your personal identity and any sensitive information will not be disclosed to others without your permission. If you wish to discontinue during the interview, you can let me know at any time. If you have no questions, let's begin our interview now. Shall we?

Benefits

1. During my classroom observation, I saw the teachers used different screen-based media in their lessons, for example, desktop, projector, tablet and smartphone. Why do you use them in your lessons?
2. Which screen-based media do you like to use the most? Why?
3. What behaviors you aim to increase through the use of screen-based media?
4. What behaviors you aim to decrease through the use of screen-based media?
5. Do you find it effective to use the screen-based media to achieve your aims?

Issues

1. Do you have any concerns when you use screen-based media with your students?
2. What are the behavioral concerns?
3. What are the technical concerns?
4. Any other concerns?
5. Why do you have those concerns?

Management

1. During my classroom observation, I see the teacher used different behavior systems to manage student's issue during the use of screen-based media. Can you explain:
2. (Mercury class) 1. Token system, 2. Timer system, 3. Cross system, 4. Points system
3. (Pluto class) 1. Token system, 2. Timer system, 3. Cross system, 4. Flipper system, 5. Meter system
4. What behaviors you aim to increase through the use of those systems?
5. What behaviors you aim to decrease through the use of those systems?
6. Why do you select those approaches?
7. Are they effective to increase or decrease the target behaviors?
8. Do you use any other systems to manage students' behaviors?

Others

1. How do you prepare screen-based media for your lessons?
2. What makes you choose to use screen-based media instead of traditional teaching material?
3. What training or support you get regarding the use of screen-based media to help your students and manage their behaviors?
4. How do you work with your colleagues (supervisor, teachers, admin) regarding the use of screen-based media in the class?

5. How do you work with the parents regarding the use of screen-based media to help their child and to manage their behaviors?

General

1. How do you feel about the use of screen-based media in general? (Complement, dilute, even worsen?)
2. Do you prefer to use screen-based media more or less in the future?

Appendix G: Part Four: Parent Questionnaire

Managing the Use of Screen-based Media for Students with Autism

I am FUNG Yiu Man, Raymond. I have been working in Autism Partnership Hong Kong for almost 20 years. I am always interested in learning how to help our students and teachers. Four years ago, I enrolled in the Doctor of Education Program at the University of Bristol, UK. As part of my doctoral degree, I am conducting a research on how teachers manage screen-based media for students with autism in Aoi Pui School.

The current study is a requirement of a dissertation of the Doctor of Education Program of the University of Bristol. I hope you can share your experience and opinion regarding your child and technology. I would be grateful if you would complete this questionnaire by 21 January 2019. Please put the completed questionnaire in the sealable envelope provided and return it to Aoi Pui School.

The questionnaire will take about 15 minutes to complete. It does not require you to fill in your name or other identifiable personal information. All the information collected will be used exclusively for the academic purpose of this study, and will be kept confidential. Some of the data will be shared with my dissertation supervisor. The results of the study may be submitted to academic journals. Other than that, it will not be disclosed with anyone outside the research. You may refuse to participate in this study by not submitting this questionnaire. By submitting this questionnaire, you will have given your voluntary and informed consent to use your responses for the present study.

If you have any question or concern regarding any aspect of the study, or you are interested in knowing about the outcomes of the study, please feel free to contact me, Raymond Fung, through email (yf16443@bristol.ac.uk) or phone (25263812). If you have

any problems, you can speak to me, or you can choose to contact my supervisor, Dr. Felicity Sedgewick, the University of Bristol at felicity.sedgewick@bristol.ac.uk.

Part 1: Background Information

1. What is your relationship to the child?

   ☐ Mother

   ☐ Father

   ☐ Other _____

2. Does your child use any of the following screen-based media at home? Please check all that apply.

   ☐ Desktop

   ☐ Projector

   ☐ Smartphone

   ☐ Tablet

3. How much time approximately does your child spend with the following screen-based media?

   Desktop _____ hour/week

   Projector _____ hour/week

   Smartphone _____ hour/week

   Tablet _____ hour/week

4. What does your child use the screen-based media for? Please check all that apply.

   ☐ Homework

   ☐ Learning

   ☐ Personal entertainment/ gaming

   ☐ Taking photos/ videos

   ☐ Social communication

   ☐ Utilities (e.g., timer, torch)

Part 2: Benefits

5. Please rate how positive do you think the screen-based media impact your child.

		Not positive at all	No impact	Positive	Very positive
i)	Knowledge enhancement (e.g., language, cognitive, academics)	☐	☐	☐	☐
ii)	Skill acquisition (e.g., computer skills, motor skills, reading skills)	☐	☐	☐	☐
iii)	Behavior enhancement (e.g., independence, replace stereotypic behaviors, motivate learning)	☐	☐	☐	☐
iv)	Attending	☐	☐	☐	☐
v)	Verbal communication	☐	☐	☐	☐
vi)	Social and play skills	☐	☐	☐	☐
vii)	Generalization (i.e. apply skills across settings/ people/ media)	☐	☐	☐	☐
viii)	Engagement (e.g., increase interests, enjoyment)	☐	☐	☐	☐
ix)	User-friendly (e.g., fast, convenient)	☐	☐	☐	☐
x)	Others _____	☐	☐	☐	☐
xi)	Others _____	☐	☐	☐	☐

a) Would you please elaborate on your ratings?

_____

_____

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Part 3: Issues

6. Please rate how negative do you think the screen-based media impact your child.

		Not negative at all	No impact	negative	Very negative
i)	Stereotypic behaviors (e.g., obsession, repetitive body movement/ talking)	☐	☐	☐	☐
ii)	Non-compliance	☐	☐	☐	☐
iii)	Temper tantrum (e.g., crying, screaming, aggression)	☐	☐	☐	☐
iv)	Inattention/ distracted	☐	☐	☐	☐
v)	Online risk (e.g., inappropriate content, online security)	☐	☐	☐	☐
vi)	Social issues (e.g., isolation, inappropriate talking)	☐	☐	☐	☐
vii)	Others _____	☐	☐	☐	☐
viii)	Others _____	☐	☐	☐	☐
ix)	Others _____	☐	☐	☐	☐

a) Would you please elaborate on your ratings?

_____

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Part 4: Management

7. What strategies did you use to manage the issue? Please check all that apply.

- ☐ Reprimand
- ☐ Removal of preferred item or activity
- ☐ Praise or reward the absence of challenging behavior
- ☐ Ignore/ minimal attention to the challenging behavior
- ☐ Redirection
- ☐ Verbal reminder/ Priming
- ☐ Physical enforcement
- ☐ Timer
- ☐ Tokens
- ☐ Teach alternative behavior (e.g., verbal communication, turn-taking, wait, play skills, social skills)
- ☐ Teach compliance/ following rules
- ☐ Self-monitoring
- ☐ Others _____
- ☐ Others _____
- ☐ Others _____

8. Is there anything about the use of screen-based media you would like to add?

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Thank you!

Appendix H: Examples of raw data from each part of this study

	Themes	Categories	Codes
Part One: Focus group interview	Tablet for academic learning	Teacher	We used the iPad.
		Student	They can do some academic stuff when they're having free time.
		Content	An app called ‘Khan Academy’
	Knowledge enhancement	Benefits	When you click the answer [in Khan Academy] is correct, it tells you why it is correct. When it is wrong, they will also give you a very lengthy explanation. So instead of us teaching them like one on one, or printing out some papers for them, I think this is a very good way for them to learn doing self-study.
	Disruptive behaviors	Issues	[The students] sometimes grab other's hands because they want to play the iPad. And when the game is going to be very exciting. They also grab their hands and they forgot what we have taught them about having personal space, when you have quarrel you have to talk to each other, but instead they were just grabbed the hand because the app is ongoing.
	Proactive strategies: problem solving skills, social skills, waiting	Management	For sharing we teach them how to use ‘Rock Paper Scissors’. l will teach voting as well. And we have taught them to use ‘first come first serve’, which you play for a while which we do waiting as well.
Part Two: Classroom observation	Desktop computer for skill acquisition	Teacher	Presented information on a desktop. Took video of students’ performance.
		Student	3 students sat together at the small table in front of the desktop.
		Content	PowerPoint about Villains
	Knowledge enhancement,	Benefits	Learned villain’s characteristic, did worksheet, reading, responding to questions, and receptive instructions

	Temper tantrum	Issues	Student grabbed pencil from classmate
	Proactive strategy: token economy in the form of tick system, verbal communication	Management	Teacher provided a tick when the student kept his hand to himself, asked the student to make verbal request nicely. Evaluated students' performance via recorded videos.
Part Three: Individual interview	Tablet for entertainment and as reinforcement	Teacher	We have reserved iPad only for some programs that the student has difficulty that he needs extra reinforcement, and we will use the iPad.
		Student	Watched videos.
		Content	YouTube
	Play interests and skills	Benefits	Some of them have an increase in interests in watching videos.
	Non-compliance	Issues	[The teachers] have difficulty when we try to take the iPad away from the students, like we terminate the break time.
	Communicating with parents	Management	For one of the students, we evaluate the behavior in school and the parents will reinforce the student with iPad at home. So, I will then communicate with the parents, say how many minutes he can play on the iPad on that particular day.
Part Four: Parent questionnaire	Mostly smartphone for entertainment	Parent	More use on holidays for personal entertainment
	Increase engagement	Benefits	Expanded interests
	Temper tantrum	Issues	Difficult to remove the devices
	Reactive strategy	Management	Use smartphone as reward and set time restriction