Augmenting Social Stories with Differentiated Instruction

A Study of Social Skills Acquisition in Children with Autism Spectrum Disorder

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Abstract

Social and communication skills are interactive skills acquired through socialisation. Although these skills are vital to survival in society, these are the skills that children with Autism Spectrum Disorder (ASD) commonly lack. Though ASD cannot be cured completely, social skills impairments can be improved by treatments and methods available as outcomes of research that has been carried out. Among these treatments and methods, a combination of animation and social story delivered through the laptop was proven effective in improving this social skills impairment, as animation attracts learners’ attentions while laptops motivate them to learn. However, this research believes that animated social stories created for a group of children with ASD might not necessarily work out well for another group of such children due to individual differences – socio-economic backgrounds, preferred learning styles and needs. Something needs to be done to make animated social stories work for children with different needs. As such, this research proposed to integrate differentiated instruction which encourages differentiation into social story approach to teaching much needed social skills to children with ASD acquisition and to evaluate the effectiveness of this integration. In order to do so, data were collected from 23 ASD children from a special school and a care centre located in Kuching, Sarawak. First, a prototype of Social Story App (SSA) compatible with most popular devices was developed to aid the processes of integration. In order to explore the effectiveness of the integrated approach, this study implemented two interventions: generalised animated social stories and differentiated ones. First, generalised social stories which targeted most common social skills found in school setting were developed. After identifying what social skills that students in these research sites had and lacked through the pre-assessment, suitable generalised animated social stories were assigned to individual participants and the generalised animated social stories intervention was conducted. Based on the findings of the first intervention, generalised social stories which did not work were differentiated. Another intervention using differentiated animated social stories was
made and the outcomes of both interventions were compared and evaluated. The integration was found to be successful in reducing undesirable behaviours and improving expected behaviours related to the respective social skills. Thus, findings of this study suggest that the integration of differentiated instruction into animated social stories helps children with ASD in acquiring their associated social skills successfully.
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Declarations

I declare that this dissertation hereby submitted to the Swinburne University of Technology (Sarawak Campus) for the degree of Master of Science (by Research) is the result of my own effort and has not been submitted elsewhere for the award of degree or diploma. All information sources are duly acknowledged and cited according to the primary referencing system used at Swinburne University of Technology (Sarawak Campus), Harvard Referencing System.

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Chapter 1: Introduction

This chapter states the problem of this research and proposes a solution. The aim and objectives of the research are then explained thoroughly. This chapter concludes with an overview of the dissertation to provide a full picture of this research.

1.1 Research Problem

Autism Spectrum Disorders (henceforth referred to as ASD) are a group of complex disorders of brain development which cause deficiencies in social and communication skills (National Institute of Mental Health 2014). The cause of ASD is unknown and there is no cure for ASD yet. Certain medications and methods, however, can help people with ASD to live better in society. According to the Fifth Edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-V), the commonest symptoms shared among children diagnosed with ASD are lack of basic social skills which are vital in daily lives and can be acquired through interactions with other people within the society. Limited or total lack of these social skills can seclude a person from and deny access to their society. Although ASD has no cure, people with ASD can be helped by supplementing and improving social skills that they do not have.

According to reports released by Centres for Disease Control and Prevention (2014), ASD cases are rising year by year. Likewise, an increasing number of research and studies which focus on ASD have been carried out to find solutions to this social and survival issue of people with ASD, and as a result, many treatments/methods are available to improve social skills of children with ASD.

One such approach to help improve children’s social skills is the Social Story™ which has been proven effective (Gray & Garand 1993; Scurlock 2008; Sansosti & Powell-Smith 2008; Schneider & Goldstein 2009; Mandasari 2012). Social Story developed by Carol Gray is a short story which portrays a social situation which may bring obstacles or problems in social communication, and which explains emotions and responses from
different aspects to learners. The implementation of the Social Story approach is easy and also cost-effective compared to other treatments/methods which are available.

In an attempt to find better mediums to deliver social stories, different researchers have tried to combine the social story with different delivery methods such as music, computer and audio and visual ones to increase the effectiveness of social stories (see Thiemann & Goldstein 2001; Roger & Myles 2001; Heward 2006; Schnedider & Goldstein 2009; Wallin 2009; Gabbert 2010; Mandasari 2012). Originally, social stories were delivered one-to-one, that is, someone reads for an individual person. Though effective, this consumed so much time and human resources (Mandasari 2012). To improve the method of delivery, Mandasari (2012) combined 2D animation with social stories which were delivered using a laptop. The outcomes were positive and both animation and laptop captured participants’ attention.

Though shown successful, this research considers that the effectiveness of animated social stories might vary depending on learning needs and preferences of individual students given differences in their cognitive, linguistic and socio-economic backgrounds (Guskey 2008; Kokina & Kern 2010). It means the social story which is created and works for a certain group of children with ASD might not work equally effectively for other ASD children. This requires social story to be tailored/differentiated to reach out to each and every child from the targeted group. The differentiation needs to be done, not randomly, but systematically based on the background data of the targeted children (learning styles, needs and preferences). To be able to tailor/differentiate animated social stories based on the needs of children properly, the social story approach needs to be integrated with an effective teaching method/framework which encourages differentiation.
1.2 Proposed Solution

The issue of satisfying varying needs of individual students stated in section 1.1 can be addressed by integrating a differentiated instruction into the social story approach. Differentiated instruction or differentiation is an effective teaching framework which encourages teachers to differentiate their instructions to meet the needs of every student in the classroom. Differentiated instruction has shown to be effective in both normal and special education (McAdamis 2001; Affholder 2003; Baumgartner et al. 2003; Tieso 2005). This framework is also easy to integrate with the social story approach.

This has led the researcher to determine which delivery method should be used for integration. Choosing the original delivery of the social story will pose the same issue - too much consumption of time and energy. Mandasari (2012)’s approach on social story is considered a better choice because her approach did save time and human resources. More importantly, using animation and the IT gadget (laptop) engage ASD children well. As justified later in section 2.4, a review of literature shows that using the latest gadgets like the tablet computer/ PC (normally referred to as tablet) (e.g. iPad) does produce positive outcomes. As such, the final solution proposed by this research study is to integrate differentiated instruction into the animated social story approach and deliver the social story via the tablet computer instead of the laptop.

In short, this research proposes a social story approach which integrates differentiated instruction into animated social stories which are delivered through the tablet computer to improve effectiveness of animated social stories.

1.3 Aim and Objectives

This research study proposes to integrate differentiated instruction into the social story approach using animated social stories presented via a tablet and investigates its effectiveness in ASD children's acquisition of social skills.
Thus, the specific objectives of this research are:

- To integrate differentiated instruction into delivering animated social stories to children with ASD

  This objective is to investigate how differentiated instruction could be integrated into animated social stories. To achieve this objective, a software prototype that can assist in interventions and evaluation was developed first. Pre-assessment was then conducted to obtain the detailed background of participants who were diagnosed with ASD. Then, an intervention using generalised animated social stories was conducted with participants to understand the effectiveness and weakness of generalised animated social stories. Based on data from the first intervention and pre-assessment, differentiated instruction was integrated into generalised animated social stories which did not work during the first intervention.

- To evaluate the effectiveness of differentiated animated social stories in assisting children with ASD in their social skills acquisition

  This objective is to evaluate whether the differentiated animated social stories could assist ASD children better in acquiring social skills than the generalised animated social stories. To achieve this objective, an intervention using differentiated animated social stories was conducted with participants using the prototype software. Then the results of two interventions were compared and evaluated.

In short, to attain these two objectives, using the software prototype developed for this research, two interventions using generalised social stories and differentiated ones were made and results of these two interventions were compared to measure the effectiveness of the integration of differentiated instruction to the animated social story approach.
1.4 Research Phases and Timeline

This section presents a brief overview of the research. Different research came up with different research processes using different terms and number of steps (Baltimore County Public Schools 2010; Blankenship 2010; Dudovskiy 2015). Blankenship (2010) suggested 8 processes while Dudovskiy (2015) suggested 7. Although the number of processes may be different, their fundamentals were the same: deciding research field, finding problems, literature reviews on associated domains, deciding research design, collecting data and data analysis. Based on the findings of the review of research design, procedures were developed to address the needs of this research to fit the given 24-month time frame (see section 3.1). The research procedure of this study consists of four phases: (1) domain study; (2) development of the prototype and materials; (3) conducting intervention; and (4) data analysis (see Appendix B: Research Timeline for the details of the research phases and the timeline).

1.5 Overview of the Thesis

This research thesis is composed of the following five chapters.

Chapter 1: Introduction

This chapter introduces this research study through the description of the research problem and the proposal of the solution. The aim and objectives of the research are then presented and followed by a summary of research phases conducted within two years. An overview of the whole research report is presented at the end of the chapter.

Chapter 2: Literature Review

This chapter reviews literature related to the present research. This includes a review of the nature, cause(s), symptom(s), treatments of ASD and their limitations and that of effective training methods and tools for social skills. In addition, differentiated
instruction which is a teaching framework and its effectiveness are reviewed in this chapter.

Chapter 3: Methodology

In this chapter, the design of this research is first explained in detail. After explaining research design, research setting and participants are described. This includes the research location, research sites and recruitment of participants. The potential risks analysed based on research design, setting and participants are presented. This is followed by the description of methods of observation and evaluation to increase liability of the research. The details of the research procedures are then presented and this chapter concludes with a summary.

Chapter 4: Development of Prototype and Materials

This chapter describes in detail the development of prototype application. This is followed by the way in which animated social stories were prepared and the description of observation scales used in this study.

Chapter 5: Evaluation

This chapter first describes the details of participants of the research. Next, it reports the research step by step: 1) how the pre-assessment was conducted as a basis to assign appropriate social stories to individual participants; 2) the investigation results of effectiveness of generalised animated social stories to determine which animated social stories did not work well; 3) how animated social stories which failed to help were differentiated; and 4) investigation results of the effectiveness of differentiated animated social stories. Results from both interventions are then compared according to the performance of social stories and that of each individual participant. Upon getting a clear picture of results, these results are discussed and the summary of chapter is provided at the end of this chapter.
Chapter 6: Conclusions

This chapter opens with the detailed description of the contributions of this research against the backdrop of research aims and objectives, states limitations of this research, and recommends future research and concludes with a summary.
Chapter 2: Literature Review

This chapter reviews literature related to this research study which includes what Autism Spectrum Disorders (ASD) are, what social communication impairment means to people in society, which social skill training methods and tools are available to help children diagnosed with ASD to overcome this impairment, what social story approach to social skill acquisition is like and what role the differentiated instruction plays in teaching and learning. A critical review is provided at the end of this chapter.

2.1 Autism Spectrum Disorder

The word “autism” is derived from the Greet word “autos” which means “self”. According to Kuhn & Cahn (2004), the word “autism” was coined by Paul Eugen Bleuler, a Swiss psychiatrist, for the first time in 1910 to refer to conditions in which one is taken from social interactions and enjoys in his/her own world. According to the National Institute of Mental Health (2014), Autism Spectrum Disorders are a group of complex disorders of brain development which cause deficiencies in social and communication skills. Social and communication skills are vital to human lives and survival in the workplace. They are interactive skills learnt through socialization to stimulate positive responses from people with whom they interact and enable people to engage with and be part of society. Little or lack of such skills means being denied access to the society. In order words, deficiency in social and communication skills prevents people with poor social skills and those who are suffering from ASD from participating in societal activities for their survival in their respective communities.

Before autism was defined, there were some cases which described the symptoms of autism. The earliest well-documented case is the court case of Hugh Blair in 1747 to void the marriage arrangement of Blair who had ASD symptoms petitioned by his brother (Huston & Uta Frith 2000). The case was successful.
The American child psychiatrist Leo Kanner did some research in 1943 on eleven children who were intelligent but had problems with social interactions and routine changes, echolalia and problems with memory and spontaneous activities (Kanner 1943). Later, Kanner used the term “autism” and used “early infantile autism” to refer to those children’s conditions (Veague et al. 2009). In 1944, Hans Asperger published a paper named “Die "Autistischen Psychopathen" im Kindesalter (Autistic Psychopathy in Childhood)” in the German language. His work was, to some extent, similar to Kanner’s research but the children he did research did not have echolalia or speech problem (Uta Frith 1991). Based on his work, an English researcher Lorna Wing published “Asperger’s syndrome: a clinical account” in 1981. She was the first one who used the word “Asperger’s syndrome” to refer to mild forms of autism (Wing 1981). Asperger’s work was not well known until Frith translated his paper from German to English (Uta Frith 1991).

The ASD problem is serious and ASD cases are on the rise nowadays. According to the report released by the Centres for Disease Control and Prevention in 2012, every 1 in 88 American children have some form of ASD, a 78% increase in the number compared to that of about a decade before (Falco 2012; Centres for Disease Control and Prevention 2014). According to the National Autistic Society United Kingdom (2013), 1.1% of its population (2011 population census) had autism.

Even with the advancement in medicine nowadays, causes of ASD are not still clear. Although no one has so far been able to ascertain what exactly triggers ASD, there are two factors which seem to be related to ASD, genetic factors and environment factors (National Institutes of Mental Health 2014).

Findings of research conducted by Chaste & Leboyer (2012), Won, Mah & Kim (2013), Zylka & Yi (2015) suggest genetics as one of the factors causing ASD. According to twin studies conducted by Veenstra-VanderWeele & Cook Jr (2004), monozygotic
twins (identical twins) have 60-91% concordance rate. However, Hall & Kelly (2014) later argued that the rate was overestimated and the estimate should be in the range of 37-67%. Their study also mentioned that dizygotic twins also have higher concordance rate. Added to this risk is an increasing chance of the development of ASD in the next child even in the families with one child having ASD according to National Institute of Neurological Disorder and Stroke (2015). Heritability is not all about genetic factors. DNA changes such as de novo mutation, copy-number variation (CNV) and asymmetric epigenetic changes are happening from one generation to another (Hall & Kelly 2014, National Institute of Neurological Disorder and Stroke 2015). It explains why autism appears in the family with no history of ASD. There are about 1,000 genes which might be associated with ASD (Zylka & Yi 2015). Genetic researchers are trying to find out the real culprit gene from time to time using different methods (Alarcón et al. 2008; Li et al. 2010).

Some research point to the fact that autism has some link with environmental factors. The term ‘environment’ in the study of autism covers everything except DNA inheritances (Perri Klass 2011). Autism has strong links with environmental factors such as exposures to chemicals such as thalidomide, misoprostol, and valproic acid; and to maternal rubella infection in early pregnancy (Landrigan 2010), prenatal and neonatal complications (Gardener et al. 2011), and closely spaced pregnancies (Cheslack-Postava et al. 2011). Children whose mothers did not take prenatal vitamins during pregnancies were observed to have greater risks of developing autism (Schmidt et al. 2011).

The review so far points to the fact that despite advancement in medical technology, the cause of ASD is still unknown although its significant impact on social and communication skills has been acknowledged. An increase in the number of ASD cases calls for an action to help children diagnosed with ASD who are deprived of these much needed skills. The next section will describe in detail the characteristics of
social communication impairment to justify why helping children diagnosed with ASD to acquire social communication skills is a necessity.

### 2.2 Social Communication Impairment

ASD was formerly divided into five groups: (1) Autistic disorder (classic autism); (2) Asperger's disorder (Asperger syndrome); (3) Pervasive developmental disorder not otherwise specified (PDD-NOS); (4) Rett's disorder (Rett syndrome); and (5) Childhood disintegrative disorder (CDD) (American Psychiatric Association 2000). Each of them has its own specific diagnosis. After Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (referred to as DSM-V) came out in 2013, Rett’s disorder and Childhood disintegrative disorder (CDD) are no longer under Autism Spectrum Disorder in DSM-V (American Psychiatric Association 2013). Autistic order, Asperger’s disorder and Pervasive developmental disorder not otherwise specified (PDD-NOS) are merged into ASD. Different diagnoses were removed and replaced with a single diagnosis for all sub-groups of ASD.

According to DSM-V, ASD is diagnosed based on two areas which are 1) deficits in social communication and, 2) fixated interests and repetitive behaviours (American Psychiatric Association 2013). These two areas of diagnosis can be seen below.

#### 1. Deficits in social communication include:

   a. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.

   b. Deficits in nonverbal communicative behaviours used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication to abnormalities in eye contact and body language; or deficits in
understanding and use of gestures to a total lack of facial expressions and nonverbal communication.

c. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behaviour to suit various social contexts to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.

2. Fixated interests and repetitive behaviours include:
   a. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypes, lining up toys or flipping objects, echolalia, idiosyncratic phrases).
   b. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behaviour (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, a need to take the same route or have the same food every day).
   c. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests).
   d. Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment (e.g. apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).

According to McGrath & Francey (1991); Burke et al. (2006); Eskay & Willis (2015), basic essential social skills for children are imitation, emotional expressions, facial expressions, making eye contact, following instructions, obeying rules and regulations, sharing, taking turns, playing together, accepting failures, empathy and offering support, giving and receiving compliments, disagreeing with other people properly,
saying “no” to peers when appropriate, paying attention to peers, asking for help, asking to join the group and respect opinions of other people.

DSM-V also introduces a new severity ranking system for ASD diagnosis. In this ranking system, there are three levels of severity: level 1, level 2 and level 3. The details of these three levels are provided in Table 1 below.

Table 1 Severity levels for ASD diagnosis of DSM-V

<table>
<thead>
<tr>
<th>Severity Level</th>
<th>Social Communication</th>
<th>Restricted, Repetitive Behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Without support in place, deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful response to social overtures of others. May appear to have decreased interest in social interactions. For example, a person who is able to speak in full sentences and engages in communication but whose to-and-fro conversation with others fails, and whose attempts to make friends are odd and typically unsuccessful.</td>
<td>Inflexibility of behaviour causes significant interference with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal responses to social overtures from others. For example, a person who speaks simple sentences, whose interaction is limited to narrow special interests, and how has markedly odd nonverbal communication.</td>
<td>Inflexibility of behaviour, difficulty in coping with change or other restricted/repetitive behaviours, appear frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress and/or difficulty changing focus or action.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others. For example, a person with few words of intelligible speech who rarely initiates interaction and, when he or she does, makes unusual approaches to meet needs only and responds to only very direct social approaches</td>
<td>Inflexibility of behaviour, extreme difficulty coping with changes or other restricted/ repetitive behaviours, markedly interfere with functioning in all spheres. Great distress/difficulty changing focus or action.</td>
</tr>
</tbody>
</table>
If compared with basic essential social skills for children stated earlier, it can be seen clearly that most deficits highlighted as symptoms from ASD diagnosis manual are the basic social skills essential for children. In other words, children with ASD are deficient in basic social skills essential for children.

Recognizing the significance of social skills for human being and aiming to help ASD children to become independent individuals, research has been carried out to look for answers to questions such as what social skills should be taught and how these social skills can be taught to children with ASD. Research carried out so far suggests that some common social skills which are lacking in children with ASD are imitations, facial expressions, emotional expressions, asking for help, asking to join group activities, sharing, cooperating and supporting/helping peers (Gresham & Elliot 1990; Bohlander et al. 2012; American Speech-Language-Hearing Association 2014). According to Sanrattana et al. (2014), self-control behaviours such as waiting, asking for permission, cooperating and calming down, and communication skills such as making eye-contact, greeting and recognizing other people’s opinions, are also commonly deficient in children with ASD in inclusive schools.

As the social skills are essential for daily lives, lack of these social skills disadvantage these children to become full-fledged members of the community. Hence, training social skills that they lack becomes the most effective way to help children with ASD not only to improve their personalities such as self-esteem, motivations and satisfaction, but to enable them to gain better achievements in schools and at works (Loomis 2008; Bohlander et al. 2012). Most importantly, this will empower them to contribute their talents fully to the community in which they live.

2.3 Social Skills Acquisition

As Wilson (2012) states, social skills can be improved by using specific teaching methods in systemic ways. Tools and methods for teaching and learning social skills
that have emerged so far have specifically been designed for children with ASD. Some typical effective treatments include behaviour modification therapies, computer-based therapies, robot-based therapies, visual- and audio-based therapies and Social story.

According to Waltz (2003), behaviour modification treatments constitute any system controlling behaviour by means of reward and punishment. Effective behaviour modification therapies are Applied Behaviour Analysis (ABA), Developmental Individual Difference Relationship Model (DIR), Relationship Developmental Intervention (RDI), Training and Education of Autistic and Related Communication Handicapped Children (TEACCH) and Social Communication/ Emotional Regulation/ Transactional Support (SCERTS). Although most behaviour modification treatments are effective in their own ways, there are some drawbacks which are time-consuming process and high costs. For example, ABA needs 40 hours per week up to 2 years (Dodd 2005). Cost which is directly proportional to time is another limitation. Paucity of qualified therapists adds to the list of limitations. Moreover, restricted training on social skills and needs may result in programmatic or robotic behaviours of these children.

On the other hand, computer-based therapies are computer-assisted learning which makes use of interactive computer software to train students to improve their social skills. Computer technology is a natural interest for children with ASD who have problems with concentration. Taking advantage of children’s natural interest in computer, interactive computer software has been developed to capture the attention and enhance/heighten the concentration of children with ASD and enable them to get involved in learning activities. Some examples of interactive software are Learning for Children, MindReading, Model Me Interactive™: Practicing Conversation, MouseTrial and MyYard. Although computer assisted learning has little or no shortcoming, most interactive computer software focuses on certain specific points only.
As the name suggests, Robot therapies make use of robots to interact with ASD children. As in the case of computer-assisted learning, use of robots in this case is encouraged by the fact that robots can capture these children’s attention more than human partners can do (Ricks 2010). In addition, most robots are able to adapt the behaviours according to the given situation and interact naturally. Some examples of robot therapies are Russell, Milo (Robokind 2014) and Nao (AldebaranRobotics 2013; Aldebaran 2015). Though effective, cost is one of the pitfalls of Robot therapies. Besides, robots like Russell need a space or environment to set up sensors and accessories (BrainFacts.org 2015). Safety is another question. More importantly, children may be addicted to robots that can result in leaving little or no time for them to communicate with people. This would defeat the purpose of using robots to train children for socialising with people.

Visual-based and audio-based therapies include Video Modelling (VM), animation and music therapy. There are two fundamental processes in this visual learning theory: modelling and imitation (Alzyoudi et al. 2014). According to Alzyoudi et al. (2014), modelling is a demonstration of a positive behaviour that is intended for the viewers to learn by imitation.

VM demonstrates positive examples by a model recorded as a video which is later shown to the audience (children with ASD) repeatedly until they can imitate. VM has been shown as an effective visual method of teaching social skills (Baker 2007; Wang et al. 2011). But VM takes at least two people to produce a video.

Both 2D and 3D animation are included in animation-based therapies whereby animation enhances children’s learning of social situations. The quality and smoothness of the animation depend on how the creator blends still images to appear as live motion in human eyes (Its Esl 2009). Nevertheless, as Baron-Cohen et al. 2009; Holmggaard et al. (2013) pointed out, using animation yielded positive results in
improving ASD children’s understanding of other people’s emotions. Although animation is effective, creating good animations may pose some problems such as skills on art and computer graphic design, complexity and cost of animation software for normal users even if they are familiar with some computer software.

On the other hand, the music therapy utilizes music as a communication medium to address social behaviours. Initially, this therapy was meant for individual. Later, family approaches whereby the therapy session is joined by one or more family members have shown good results recently (Oldfield et al. 2012, Thompson 2012). The only issues with this therapy are that there is no particular music which is effective with children with ASD and that the music therapy needs to invest a vast amount of time to produce effective music for these children (Berger 2002; Brunk 2004).

The literature so far reviewed spotlights behaviour modification therapies, computer-based therapies, robot-based therapies, visual- and audio-based therapies as some existing effective treatments for children with ASD.

The following section will focus on the history and nature of social story approach, social story intervention as a tool to deal with social-skill deficits of children with ASD, mediums or methods employed for the social story intervention to make learning these social skills more effective and their pros and cons finally to point to the virtues of information technology gadget and application to captivate the attention of ASD children with limited attention span.

2.4 Social Story Intervention
Social Story™, as developed by Carol Grey in 1991 (Gray & Garand 1993), is a short story which describes a detailed situation which may bring obstacles or problems in social communication and provides the learners with solid information to face the situation or overcome the obstacles (Scurlock 2008). Social story does not direct the audience what exactly they have to do. Instead, it describes a detailed specific situation
to better understand the situation and provides the audience with possible outcomes or responses to help the audience to improve their social behaviour in that situation. By describing the specific situation and providing information from all aspects of the situation, the social story helps the audience to become aware of possible expected behaviours in that situation, feelings and opinions of other people (Gabbert 2010). The fact of helping the children with ASD to have the capacity to show concern for other people suggests that social story endeavours to tackle the social communication impairment of children with ASD. Social story has also acquired good reputations for teaching or improving social skills of children with ASD (Schneider & Goldstein 2009).

The literature suggests that three basic steps are required for the development of a social story (Gray & Garand 1993). First of all, the problematic social situation of the targeted child needs to be figured out as it will be the focus situation of the social story. Upon identification of the situation or the focus of the story, as the second step of development, the setting in which such a situation occurs needs to be established. Information needed for the establishment of the setting can be gathered through observation, interview with parents, teachers and caretakers. The information concerning both the targeted child and his/her aspects or opinions about that situation has to be noted down (Gary 1995). The final step of the development requires the collected data to be shared with the targeted child as well as all other stakeholders such as parents, caretakers and teachers.

When writing social stories, the most important thing is to take account of the level of reading and cognitive skills of each targeted child (Gray & Garand 1993, Gray 1995). That is, the story must be written at the level that the targeted child can understand. If the targeted child has problems in either reading or understanding the story read by someone, as pointed out by Kokina & Kern (2010), there may be little or no effect on the social skill acquisition.
Four types of sentences are needed as suggested in the original guideline of writing social story. These sentences include 1) descriptive sentence, 2) directive sentence, 3) perceptive sentence and 4) affirmative sentence (Gray & Garand 1993). Descriptive sentences distinguish or describe the targeted social situation and its relevant variables. Most of the descriptive sentences answer some questions such as when and where the situation occurs, who are involved, and what and why they are doing. Directive sentences, on the other hand, help in depicting a favourable response(s) to the social situation in a positive tone (use “I will” or “I can” rather than “I should” or “I have to”). Perceptive sentences refer to the responses, aspects, opinions and emotions of other people involved in the social situation. This kind of sentence endeavours to deal with ASD children’s social communication impairment. Affirmative sentences, in this case, describe common belief(s) in a given situation. They can also be used to emphasize the key points to reassure the audience. Later in 2000, Gray (2000) added control sentence and cooperative sentence to the list (Gray 2000). Control sentences are more like key sentences for the audience either to recall or apply the information. Cooperative sentences inform the audience who are able to help them in a given situation. Note that not all types of sentences need to be used in composing a story (Washburn 2006). A social story is expected to be mainly composed of descriptive and perspective sentences because the purpose of social story is to describe a specific situation and provide solid information about possible expected response to the situation and emotions and opinions of other people.

The most common mistake in writing social story is instructing the audience using many directive sentences in the story (Gary 1998). It is suggested that more positive terms such as “I will” instead of “I should” be used as mentioned earlier (Brownell 2002). For blending sentences, Gray suggested two ratios for social story. The first ratio is basic social story ratio which is composed of two to five descriptive sentences, perspective sentences, and/or affirmative sentences for every directive sentence in the
story. The second ratio is the complete social story ratio which is almost the same as the first ratio, but which combines control and cooperative sentences.

The formal method of presenting social story is in plain text on the paper without any graphics and teachers or caretakers read the story from the text aloud for the children. This method is most effective when one teacher reads stories and takes care of one single pupil at a time (Mandasari 2012). The social story delivered through this formal method was proved to be positively effective in the study of individualized social story intervention made by 10-year old participant with Asperger Syndrome to train sportsmanship (Scurlock 2008). However, given the use of one single participant, the result of this research could not be generalised. In addition, the advantage of this formal method was outweighed by the fact that it was time-consuming and needed human resources.

Bearing in mind the limitations of the formal delivery approach and recognising ASD children as visual learners, different researchers have combined social stories together with other components to achieve better outcomes. Presenting social story integrated with pictorial icons in the book form improved behaviours and understandings of the ASD children (Swaggart et al. 1995; Kuttler, Myles, & Carlson 1998; Agosta et al. 2004). However, given the number of participants involved in the intervention, for example, three participants in the research of Swaggart et al. (1995) and one participant in the research of Kuttler, Myles, & Carlson (1998) and Agosta et al. (2004), these research results could not also be generalised. In addition, reinforcement of the reward system in the research of Agosta et al. (2004) raises the question of the validity of the clear impact of these visual clues on the social behaviour of these children.

People’s quest for a better and more effective approach to presenting social stories has resulted in a shift from the formal delivery to ones which employ different media and emerging information technology, as according to Wallin (2009), reinforcing visual cues
such as picture, drawing and real objects to social story could improve the effectiveness of the social story. Social stories employing different media have been proven to be effective although in some cases the results may not be generalizable given the small number of participants involved in the research.

According to Schneider & Goldstein (2009), a research was conducted with three children with ASD to investigate the effectiveness of the social story with reinforcing visual schedules which were pictures and catchy phrases selected from social story. The research had two phases: (1) written social stories were presented first using the formal delivery method; and (2) these formal social stories were then replaced with visual schedules. The result of that research positively substantiated the effectiveness of social story which used visual schedules given the improvement in the participants’ behaviour. Although the number of participants did not allow the research to make a strong case as in the research by Scurlock (2008) and Agosta et al. (2004), this research result lends itself to supporting the effectiveness of social stories presented using visual schedules.

Another ground-breaking method of presenting the social stories is the use of comic strip conversations (CSC) which refers to activities where people are “drawing and talking” (Gray 1994). CSCs are visual presentation of diverse levels of communications using symbols, stick figure drawings and colours. In CSCs, stick figures represent people and the bubbles above the stick figures signify thoughts of the people. CSCs help the learner to predict what kinds of mental states that people in the conversation may be in, and to understand other people’s points of view (Dodd 2005). In some cases, chatting phrases are included to help the learner better understand the thoughts and actions of people involved in the specific conversation. CSCs are quite close to social story in explaining the mental states and responses of other people in a specific conversation (Gray 1995). The difference between normal social story and CSC is the content as the content of CSC comes from the learners. In the CSC approach, the
learner or the child with ASD is persuaded to be the lead and to draw while the teacher or the assistant helps him or her to understand the situation (Gray 1994). According to Rogers & Myles (2001), social stories presented in CSC were successful in changing the behaviours of a 14-year old child with ASD. Although the participant was reported to enjoy using it repeatedly, the reliability of the results is in question given the use of one single participant as in the case of some research reported above (Kuttler, Myles, & Carlson 1998; Agosta et al. 2004; Scurlock 2008). In addition, this method requires one dedicated person (teacher/assistant/caretaker/parent) to have a conversation with one particular students at a time and it would be too taxing for teachers with many students under their care to handle.

Gray (1994) mentioned that several different types of materials can be used in CSC, each with advantages and disadvantages and materials have to be used wisely to meet the desired situation, and needs and interests of the targeted child. For example, one of the CSC materials, laminate marker boards, can be bought easily in most office supply stores and are available in most classrooms (Gray 1994). The advantages of laminate boards are the availability of a wide range of colour markers and changes can be made easily (Gray 1994). However, space needed for the new drawings requires the previous drawing to be erased. In complex conversations, reference to previous drawings is required for the child to reflect and digest the content to better understand such situations. However, inevitability of erasing previous drawings prevents the child or the teacher from referring to them.

Brownell (2002) adapted social stories in musical format and Pasiali (2004) followed the guidelines of writing the text of the social stories to create prescriptive therapeutic songs to reduce ASD kinds’ undesirable behaviours as identified by their parents (See also Scattone 2007). In Brownell (2002)’s approach, a social story was created in two versions: (1) an original written social story and (2) a song composed of the text from social story as lyric. Results of this research pointed to the fact that social stories
integrated with music were effective in reducing disruptive behaviours of children with ASD.

With emergence of computer and other related electronic gadgets, most ASD children find computers intrinsically motivating (Sansosti & Powell-Smith 2008). Children with ASD appeared to learn better on computer than from the teacher (Heimann et al. 1995). In 1991, Hagiwara and Myles created multimedia social story program which combined social story and computer for the first time and was tried with 3 participants (Hagiwara & Myles 1999). Although the results displayed only one participant who showed obvious improvement of behaviours, the research demonstrated possibility of integrating technology in presenting social stories.

In 2008, Sansosti and Powell-Smith combined video modelling and social stories and presented them to 3 participants using computers. The intervention was successful, resulting in significant behavioural changes. Social stories presented in slide show on computer were also effective (More 2008). Mandasari (2012) combined social stories, animation and computer to overcome the drawbacks of the formal delivery method (i.e. time and human resources required for reading). Using flash technology, she created 2D animated social stories, and presented them to 30 children with ASD using a laptop. Five social stories were made available in two languages, English and Bahasa Malaysia. The results of her research showed that the animation was able to capture children’s attention and improve the effectiveness of the social stories. Laptop also motivated the children with ASD to learn independently.

As technology advances, laptop computer is not the only choice of technology which children with ASD are interested in nowadays. Tablet computers, especially iPad have become very useful and appealing to students not only in general education but also in special education (Shore & Rastelli 2006). According to Shore, iPad decreased some symptoms such as control and attentions of autism (Shore & Rastelli 2006). According
to Brandon (2011), a mother claimed that iPad not only lessened her son’s disorder symptoms but also improved his communication skills. Flores et al. (2014) created 5 social story videos by combining social story with video modelling and presented them to 7 participants using Apple iPad2. The results showed desirable changes in behaviours of all 7 participants. Kim et al. (2014) investigated the effect of tablet-assisted social stories on three participants with ASD. The stories were created using Prezi and presented to the children using a tablet. According to their research data, tablet-assisted social stories intervention not only decreased disruptive behaviours such as making noises and leaving classroom without permission but also increased academic engagement such as paying attention to teachers’ instructions and asking for help. However, given the use of three participants, the results could not also represent children with ASD in general.

Many applications related to social stories are available on most of the popular platforms such as Windows, iOS and Android. Some examples of the commercial applications include “storysmart1: Trudy goes to the beach – social language skills” (only iPad), “Touch and Learn – Emotions” (iOS), “StoryMaker™ for Social Stories” (iOS) (StoryMaker for social stories 2014), “Stories2Learn” (iOS), “TFA – Tools for Autism” (Android) and “AutismXpress” (Android) (StudioEmotion 2011). “Storysmart1: Trudy goes to the beach – social skills” provides a text story (with some pictures) about going to the beach and asks the player to correct some manners in the text to complete the game and it is only available in iPad (Ruby Cube Inc 2013). “Touch and Learn – Emotions” provides emotion pictures and lets players learn about emotion. Similarly, “AutismXpress” is the application to learn about emotions. “StoryMaker™”, “Stories2Learn” and “TFA – Tools for Autism” provide social stories in pictures and narrations (CSP - Innovazione nelle ICT s.c.a r.l 2013). They also have an interface to create or edit social stories. This unique feature allows teachers, caretakers and parents to create and edit social stories and saves them from having to source for
another software to create/edit the social stories. The following table summarises, in chronological order, how reported research on social stories in various forms have helped children with ASD in terms of the research cited, type and format of social story, the platform used, target behaviour(s) of the research and the outcome.

Table 2 Summary of research on Social Story Intervention

<table>
<thead>
<tr>
<th>Citation</th>
<th>Type &amp; Format of Social Story</th>
<th>Platform</th>
<th>Sample Size &amp; Description</th>
<th>Targeted Behaviour</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swaggart et al. (1995)</td>
<td>Social Story text with photographs printed on 6” x 8.5” papers</td>
<td>Papers bound with red spiral binder</td>
<td>Sample Size = 3</td>
<td>Sample Age (year) = 11, 7, 7  • Greeting, • Sharing, • Aggression.</td>
<td>Reduced aggressive behaviour and improved greeting and sharing</td>
</tr>
<tr>
<td>Kuttler, Myles, &amp; Carlson (1998)</td>
<td>Social Story text with corresponding icon printed on 6” board</td>
<td>The boards bound with two metal rings in book form</td>
<td>Sample Size = 1</td>
<td>Sample Age (year) = 12</td>
<td>• Tantrum in two different settings: ➔ work time; and ➔ lunch-time.</td>
</tr>
<tr>
<td>Hagiwara &amp; Myles (1999)</td>
<td>Multimedia Social Story program with static images and audio clips</td>
<td>Mackintosh Computer</td>
<td>Sample Size = 3</td>
<td>Sample Age (year) = 7, 8 and 7</td>
<td>• Washing hands, • On-task in 3 different settings.</td>
</tr>
<tr>
<td>Rogers &amp; Myles (2001)</td>
<td>Social Story followed by Comic Strip Conversations</td>
<td>Paper</td>
<td>Sample Size = 1</td>
<td>Sample Age (year) = 14</td>
<td>• Confusing, • Making facial grimaces, • Flapping hands, • Talking to oneself</td>
</tr>
<tr>
<td>Brownell (2002)</td>
<td>Social Story integrated with music, the lyric of which was created from the social story text</td>
<td>Text from Social Story used as lyric</td>
<td>Sample Size = 4</td>
<td>Sample Age (year) = Between 6 - 9</td>
<td>• Echolalia, • Following directions, • Loud voice, • Coping with changes.</td>
</tr>
<tr>
<td>Agosta et al. (2004)</td>
<td>Social Story integrated with pictorial icons and tangible reward system</td>
<td>Book with each page including one sentence with appropriate pictorial icon(s)</td>
<td>Sample Size = 1</td>
<td>Sample Age (year) = 6</td>
<td>• Screaming, yelling, crying, or loud humming during group circle-time activity</td>
</tr>
<tr>
<td>Pasiali (2004)</td>
<td>Social Story integrated with music with the lyric created from the social story</td>
<td>Text from Social Story used as lyric</td>
<td>Sample Size = 3</td>
<td>Sample Age (year) = 7, 9 and 8</td>
<td>• Aberrant vocalisations, • Inappropriate usage of the VCR’s remote control,</td>
</tr>
<tr>
<td>Source</td>
<td>Type of Social Story</td>
<td>Media</td>
<td>Sample Size</td>
<td>Sample Age</td>
<td>Behaviours</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------</td>
<td>-------</td>
<td>-------------</td>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Sansosti &amp; Powell-smith (2008)</td>
<td>Social Story combined with Video Models</td>
<td>Computer</td>
<td>Sample Size = 3</td>
<td>Sample Age (year) = Between 6 - 10</td>
<td>Uncontrolled food intake.</td>
</tr>
<tr>
<td>Scurlock (2008)</td>
<td>Social Story text on paper</td>
<td>Spiral bounded papers</td>
<td>Sample Size = 1</td>
<td>Sample Age (year) = 10</td>
<td>Behaviours on sportsmanship</td>
</tr>
<tr>
<td>Schneider &amp; Goldstein (2009)</td>
<td>1.25&quot; visual schedule cards with pictures and short phrases adopted from Social Story</td>
<td>6&quot; x 9&quot; black foam board on which visual schedule cards were presented</td>
<td>Sample Size = 3</td>
<td>Sample Age (grade) = kindergarten to fifth grade</td>
<td>Transition, On-task, Off-task.</td>
</tr>
<tr>
<td>Mandasari (2012)</td>
<td>2D animated social story application</td>
<td>Laptop Computer</td>
<td>Sample Size = 30</td>
<td>Sample Age (year) = Between 4 - 17</td>
<td>Greeting, Joining activity, Sharing, Walking in the hallway, Washing hands.</td>
</tr>
<tr>
<td>Flores et al. (2014)</td>
<td>Social Story integrated with Video Models</td>
<td>Apple iPad2</td>
<td>Sample Size = 7</td>
<td>Sample Age (year) = Between 3 - 9</td>
<td>Playing with friends, Checking one’s schedule, Using one’s walking feet, Keeping hands to oneself Greeting others.</td>
</tr>
<tr>
<td>Kim et al. (2014)</td>
<td>Social Story created on Prezi (slide-show)</td>
<td>Samsung Galaxy Tab</td>
<td>Sample Size = 3</td>
<td>Sample Age (year) = 17</td>
<td>Off-task Disruptive behaviours</td>
</tr>
</tbody>
</table>

All the research so far carried out suggest social stories presented in media and different gadgets available at the time of research bring about the following advantages to children with ASD who have problems with concentration and attention span:

1. Motivating and capturing their attention;
2. Helping them acquire the necessary social skills;
3. Decreasing their disruptive behaviour; and
4. Increasing academic engagement.

The researchers’ creative venture of making social stories using application in the compatible gadgets appealing to the children has given rise to an increase in the effectiveness of social stories in social skills training, and consequently, an increase in these children’s independence.

2.5 Integration of Differentiated Instruction

As Guskey (2008, p.198) points out, “due to students’ individual differences, no single method of instruction works best for all”. Similarly, social stories created may not be equally effective for children with ASD who come from different backgrounds: different upbringing; different socio-economic status of the family. This has called for the use of differentiated instruction to be integrated into the social story approach to the teaching and acquisition of social skills to make social stories more effective.

Differentiated Instruction or differentiation is an effective teaching framework which encourages teachers to differentiate their instructions to meet the needs of every student in the classroom. As suggested in Aldridge (2010), it should be applied in a way that does not change learning outcomes but rather change how the content is delivered. The aim of implementing differentiated instruction is to amplify development of each student based on their culture, strength, characteristics and learning styles instead of changing them to fit with the curriculum (Hall 2002). Tomlinson (2001) recommends that teachers should personalize or customize teaching materials and instructions responding to varied learning needs of different students based on the need analysis data. Tomlinson & Susan (2000) mentioned that differentiation can be implemented in the content, process and product of the curriculum as can be seen in the following figure.
To better understand the integration of differentiation in this study, understanding of stages of differentiation is significant. As such, these stages are described in detail below.

a. Content

Content includes anything the students need to learn and how the students need to achieve them. Different elements and material can be used to support students for easy access to contents (learning materials). An individual can learn best in "zone of proximal development" where moderate levels of context are provided (Vygotskij 1978). Each student has different scales of moderate challenges and hence, contents should be differentiated to fit with the learning zone of each student. The learning zones of students can be analysed through their learning profiles. Sometimes it is hard to adjust in some extreme cases. For example, some students still practise multiplying by two while other students are able to multiply by seven. In such cases, content differentiation should focus more on concepts rather than very detailed or unlimited facts.

b. Process

Process or activity is how the student gets the key points or concepts of the targeted subject. Dynamic grouping is suggested to use consistently. Students are expected to cooperate together to achieve the given task(s). Either small
group or big groups of students will be formed based on the content, nature of project and skills of students. Teacher must consider how to organize efficiently and deliver contents effectively.

c. Products

The products are what students produce at the end of lessons to exhibit the mastery of the subject.

To prepare for differentiation, it is suggested to use assessment/formative data (Brimijoin, Marquissee & Tomlinson 2003). Assessment here refers to both on-going assessment to measure instructions and pre-assessment that serves as a pedagogical tool to diagnose or analyse details about the students to understand more about students (Hall 2002). The success of differentiation depends on purposeful pre-assessment, be it formal or informal. Combination of pre and on-going assessments can assist teachers to create better approaches, more choices and efficient learning styles for the students. Teachers should create tasks which are fascinating, enthralling, and accessible to key comprehension and skills but challenging for the children. The products may vary depending on the students’ understanding and knowledge.

According McAdamis (2001), using differentiated instruction significantly improves test scores of students who previously scored low in the Rockwood School District. Differentiated instruction improves not only student growth but also teachers’ self-confidence (Affholder 2003).

Baumgartner et al. (2003)’s research to improve reading skills of primary and middle school students employed differentiated strategies such as flexible grouping, increasing self-selected reading time and easy access to a wide range of reading materials. According to Baumgartner et al. (2003), the implementation was successful and improved students’ reading skills such as levels of instructional reading, usage of comprehension strategies and decoding skills.
The effectiveness of differentiation in curriculum was investigated between the students who received differentiated intervention and the students who did not receive (Tieso 2005). An assessment based on the curriculum was used to test before and after the curriculum for evaluation purpose. The students who received the intervention achieved significantly greater than those who did not. Karadag & Yasar (2010) also investigated the effectiveness of differentiated instruction approach on the attitudes of thirty students in a Turkish course. According to the findings, the effectiveness of the differentiated instruction was positive and students’ academic performances were improved. Another similar research reported that implementing differentiated instruction in mathematics (college level) remarkably improved the students’ mathematical understandings (Chamberlin & Power 2010). In the research, the instructors planned activities based on learning objectives of the course to observe on the students’ backgrounds which included readiness, personal interests and learning profiles to understand the needs of students regarding the course. The instructors differentiated instructions based on the observed data. The students were also assessed through ongoing assessments such as homework, quiz and projects, and were asked to choose one of their works to present as their results.

In the beginning, the application of differentiated instruction included special children but the idea of differentiated instruction has also been well accepted in inclusive classrooms (Lawrence-Brown 2004). Inclusive classrooms are general education classrooms in which students with or without disabilities learn together (Hughes 2014). Differentiated instruction has also been proven as effective in special education (Daily 2005).

Affholder (2003) conducted a research which implemented differentiated instruction in an inclusive elementary classroom. One of the findings from the research is that some differentiated contents which were meant for high functioning students were effective with a wide range of the students. The research investigated effectiveness of
differentiated instruction not only on students but also on teachers. Twenty-six teachers who received 15 hours of training about differentiated instruction were tested using the Stages of Concern (SOC) Questionnaire to find out their opinions and mastery of differentiated instruction. SOC Questionnaire used in this research was a structure of questionnaire developed by Hall & Hord (2001) to measure stage of concern regarding educational innovations. Only 6 teachers got the lower level of concern for implementing differentiated instruction. The research showed overall positive outcomes.

Darrow (2015) investigated the effectiveness of differentiated instruction on five students with different disabilities in the music classroom. According to the data stated in the research, the effectiveness of differentiated instruction was positive and the learning outcomes of students were better than what had been expected.

2.6  Critical Review
The reviews in sections 2.3 and 2.4 suggested Social Story™ as the best approach in terms of cost, time and technique at the time of this research. According to the reviews, the effectiveness of social story was unstable (Sansosti, Powell-Smith, Kincaid 2004; Reynhout & Carter 2006; Kokina & Kern 2010). The formal method of presenting social story read aloud by someone to an individual at a time is handy to be used in a class of children with ASD whose attentions are scattered (Crozier & Tincani 2007). However, the method has to be customized according to the number of students involved.

In fact, social story was shown to be more effective when the children read the stories themselves instead of teachers, parents and caretakers (Kokina & Kern 2010). This method can also save time and human resources in the classroom and home setting. However, this method is out of the question if children involved either have poor reading skill or cannot read at all. The use of illustration seems to work better for such children than the written text does.
However, according to Gray and Garand (1993), illustrations may cause the children to portray them in the ways which were not meant to. It was modified later to use illustration with written text (Reynhout & Carter 2009). At the time of this research, there are different kinds of illustration or visual cues stated in the reviews in sections 2.3 and 2.4. Mandasari (2012) proposed computer-based flash application which includes five (5) 2D animated social stories for children with ASD to overcome the limitations of consumption of time and human resources of formal social story. The evaluation of her research indicated that the use of laptop computer saves time and human resources for reading aloud. In addition, both 2D animation and the use of laptop computer could capture the attentions of the children with ASD.

In spite of demonstrating improving effectiveness of social stories, those animated social stories were designed and applied generally as interventions to all participants regardless of their backgrounds. There were not dedicated animated social stories to individual participants with varied social skill needs. In fact, the social stories writer must be aware that not all social stories work well for every child (Vicker 1998). According to Kokina & Kern (2010), effectiveness of social stories may vary depending on the background of individual children – varying level of reading skills, background knowledge, upbringing etc. These suggested that social stories which were created for a group of children might not work well with another group of children. This calls for further research to explore ways to make social stories more effective to give equal opportunities to all children. To fill this gap, this research study proposed the integration of differentiated instruction into animated social stories to make the intervention effective for all targeted children.

This chapter has discussed the domain study of this research while the next chapter will discuss on the methodology of this research.
Chapter 3: Methodology
This chapter describes the research design followed by an account of the research setting and participants. After that, the analysis of potential risk and the methods for observation and evaluation are presented. Then, the details of research procedures are explained and the summary of this chapter is presented at the end.

3.1 Research Design
This research was designed to achieve the research’s objectives: (1) to integrate differentiated instruction into animated social stories and (2) to evaluate differentiated animated social stories in assisting children with ASD in their social skills acquisition. Depending on the research objectives and questions raised for the research, one or both of the research approaches which are quantitative and qualitative approach are employed. Quantitative approach uses numerical data to discover facts and patterns while qualitative approach explores underlying reasons and opinions to deal with problems. Each approach has its own advantages and disadvantages. This research employed a mixed approach which combines qualitative and quantitative approaches. The details of the research intervention are presented in section 3.4 and the research overview is portrayed in Figure 2.

To achieve the first objective, pre-assessment was conducted for collecting the participants’ data which was required for differentiation. Pre-assessment utilised three research methods which were (1) social skills survey (see Appendix G), (2) observation of the participants, and (3) informal interview. Social skill survey form was used to assess the status of the participants’ social skills. Data collected via survey were validated through the observation of the participants in their natural setting by the researcher. If there were a mismatch between the survey data and observation data, informal interview would be conducted with the associated teachers to obtain accurate data.
To accomplish the second objective, the generalised animated social story intervention was conducted before the differentiated animated social story intervention. Effectiveness of the respective Interventions is usually evaluated by comparing behaviour changes of the participants before and after the intervention process. However, the integrated approach cannot be evaluated in this way because the effectiveness of implementation will not come clear by comparing behaviour changes observed in pre- and post- intervention. The usage of animation and tablet computers have been shown effective in others’ research (Mandasari 2012; Kim et al. 2014). Even if the outcomes of this research were positive, identifying these outcomes as effectiveness of the differentiation may not be strong enough. To evaluate the effectiveness of differentiated animated social stories, the most suitable way is to compare it with the effectiveness of generalised animated social stories. This requirement justified the additional implementation of the generalised animated social story intervention before the differentiated animated social story intervention.

This posed another question whether the interventions should be conducted on the same participants or different participants (2x2 research design). Using the same participants in two different interventions may post an evaluation problem, possible effect of learning through the first intervention on the outcomes of the second intervention. It means the improvement seen in the second intervention might be the result of learning from the first intervention. 2x2 research design is the research design in which participants are divided into two groups: control group (baseline) and experimental group (focus of the research) and compare the results. Using 2x2 research design may enable the researcher to prevent this possible learning effect problem. However, 2x2 research design was not adopted due to time and resources constraint. Having a very limited number of participants did not allow the researcher to divide them into two groups and conduct the intervention within the limited time.
Using the same participants, the learning effect of the first intervention is unavoidable. To minimise this risk, the following four measures were taken:

1. Only animated social stories which have little or no effect in assisting children with ASD in the first intervention would be differentiated and used in the second intervention.

2. There was a two-month interval between the first and second interventions. This lapse of time between the two interventions was needed to analyse the first intervention data to differentiate generalised animated social stories and assign appropriate differentiated ones to the participants. This two-month gap may minimise possible effects of learning via the first intervention.

3. Dependent t-test commonly used in comparing effectiveness of two interventions on the same group of participants was employed to compare the effectiveness of the two interventions (see section 3.4).

4. Evaluation of the effectiveness of the differentiated social stories was measured in such a way to determine whether or not the effectiveness of the second intervention was the impact of learning through the first intervention. This was done not only through the comparison of the performance of the participant population in both versions of each individual social story but also through each individual participant’s sessional performance in both interventions.

The first and second measures were taken to reduce likely learning effects of the first intervention on the performance of participants in the second intervention. But even a poorly designed story may be able to help one or two participants in acquiring associated social skill. As such, the third and fourth measures were taken. Using the same participants in both interventions had a big advantage i.e. more data from the participants could be collected from the first intervention. Those extra collected data could assist more in differentiation. The finalised research design used in this study is as follows.
• Conducting pre-assessment: Pre-assessment was conducted to find out the
details of the participants through Social skill survey, observation and informal
interview.

• Investigation of the effectiveness of common/generalised animated social
stories: A ten-session intervention through the tablet computer was conducted
using animated social stories developed for the students with ASD in general.

• Differentiation of generalised animated social stories: Data collected from the
intervention with generalised animated social stories pointed to animated social
stories which did not assist the participants much in acquiring associated social
skills. Those animated social stories which had little or no effect were revised
using data collected through pre-assessment and the intervention with
generalised animated social stories. To monitor the progress of the participants
in the differentiated animated social story intervention, on-going assessments
were also created and added to the social stories used in the second
intervention.

• Investigation of the effectiveness of differentiated animated social stories: A ten-
session differentiated animated social intervention was conducted through the
tablet computer.

With a comparison of the effectiveness between two interventions, this research can be
said to employ the quantitative approach whereas the whole concept of implementing
differentiated instruction is not quantitative at all. Particularly, the approach of
conducting pre-assessment and differentiating animated social stories to understand
the needs of the targeted children, investigating the reasons why these children were
prevented from picking up associated social skills to fulfil their needs in overcoming
their social communication problems are definitely qualitative in nature. Thus, it can be
concluded that this research employs a mixed method approach which is the
combination of qualitative and quantitative approaches.
Figure 2 below depicts the research procedure used in this study. As can be seen in the figure, this research was carried out in four phases and the details of these four phases are provided in section 3.5.

![Figure 2 Overview of the Research](image)

3.2 Research Setting and Participants

As this research aims to investigate the effectiveness of animated social stories complemented by the differentiated instruction in the social skills training of children with ASD, this research mainly targeted:

1. Students who have been diagnosed with ASD (except the hyperactive ones), with an age ranging between 5 and 16; and
2. Teachers and parents of these students.

This research considers students who were observed to be unable to sit and watch video for at least two to five minutes as hyperactive students.
The research participants were recruited from PERKATA and a care centre. PERKATA is a special education school for children with various intellectual disabilities. The care centre provides early intervention program for children with developmental delays or disabilities. Both research sites are located in Kuching, Sarawak, Malaysia.

There are some mainstream schools in Kuching where children with special needs are accepted to study in addition to these two chosen sites. Although it was ideal to include all these schools, they were not selected because approval from the Ministry of Education is required. Both PERKATA and the care centre were chosen mainly because teaching schedules from both research sites allowed the researcher enough time to conduct the research. In addition, Swinburne Sarawak has already had good working relationship with PERKATA and the researcher volunteered to provide technical assistance to PERKATA before. On the other hand, although this was the first contact Swinburne made with that care centre, the centre was willing to collaborate in this research. Besides, since the first contact, the researcher has been assisting the centre as a volunteer whenever is possible.

An approval for the research ethical clearance to conduct this research was sought first as this research involves human participation. After obtaining an approval of ethical clearance application by Swinburne’s Human Research Ethic Committee (SUHREC) (See Appendix A Ethical Clearance Approval), in order to recruit participants for this research, request letters asking for permission to conduct the research (See Appendix C Permission to Conduct Research) were delivered to the principals of the two research sites and any questions related to the research were answered.

Upon getting both schools’ approvals, tentative lists of students who had been diagnosed with ASD were requested from both school principals together with their suggestions. Research information statement and consent form were then distributed...
to the students listed through teachers (see Appendix F Research Information State and Informed Consent (Parents & Children)).

After getting consent from participants and their parents, a systematic observation and screening of participants was proceeded. Functioning as a classroom assistant, the researcher observed the participants who had given consent to the researcher. The observation focused on their interactions, characters and hobbies. To avoid misinterpretations of the students' behaviour, the researcher consulted class teachers on any vexed behaviours of the students. Each participant was observed for five school days. The following criteria were set to screen and filter the participants.

1. He/she must be a student diagnosed with Autism Spectrum Disorder.
2. He/she must be able to sit and watch video for at least two to five minutes.
3. He/she must be able to respond to teachers as this was essential for assessment sessions.

Due to locational differences of the two research sites, the research was carried out in one school per day. Participants from the care centre had only two school days (Monday and Wednesday) per week. Interventions were, therefore, conducted on Monday and Wednesday in the care centre, and Tuesday, Thursday and Friday in PERKATA.

In PERKATA, there are six classrooms, one multi-purpose hall and a kitchen. Three classrooms, the kitchen and the multi-purpose hall are on the ground floor and the other three classrooms are on the first floor. Intervention sessions were conducted individually during participants' free time. The free time of participants from PERKATA was slightly different from that of participants from the care centre. Participants from PERKATA had some free time before the snack time. Participants from the care centre had free time after their daily lessons.
According to Oldfield et al. (2012) and Thompson (2012), participants learned better in group or with family members. The researcher had planned to present the stories to participants in group. Due to time and space constraints, that plan did not materialise. In their free time, one participant was thus brought at a time to the corner of their classes where a tablet was placed on a table for the intervention session. Each session took about 8-15 minutes. The plan was to conduct 10 research sessions for each intervention. After research session, the researcher observed the participants and noted down their behaviours.

In PERKATA, due to the locations of classrooms on different floors, conducting the intervention session and observing participants from classes situated on different floors was out of the question. It was, therefore, decided to conduct research and observe participants from the classes of the same floor per day. Unlike PERKATA, it was easy to conduct interventions and observe in the care centre because there was only one single class.

### 3.3 Potential Risks

Since the beginning of the research, the researchers had discussed with the local domain experts to gather important information regarding special children and special education. Risks were analysed during the domain study phase before visiting the schools. Although the risks were minor or minimal, they were handled and mitigated with great care and given due consideration. Possible risks and measures were provided in research information statements which were distributed to schools, teachers, parents and children. The identified and mitigated risks are discussed in the following sections.

**3.3.1 During Domain Study**

Researchers paid social visits to selected research sites during the domain study to observe the ASD children. During the visits, the researcher helped occasionally as a
teaching-assistant in the classroom. Although there might be little or no physical risk, psychological risks such as feelings of insecurity, discomfort and distraction on the part of the participant children might exist. The following measures were taken to deal with these psychological risks with the cooperation of the teachers who are trained special educators in these schools.

1. The researcher made sure the presence of a qualified teacher and observation of the children without interrupting their daily activities.
2. Neither video nor audio was recorded to avoid interrupting these children.
3. The researcher always consulted the teacher and asked for their permission before doing anything related to children (for example: playing with children).
4. The researcher would leave at once if the children showed any sign of distress.

3.3.2 During Intervention
As in the social visits, no physical risk was expected in conducting the research. Psychological risks such as safety, feeling of fatigue, anxiety, distress and distraction might exist. The following protective measures were taken.

1. Ensure the presence of at least two teachers in the classroom in every research session.
2. Prior to each session:
   i. The researcher consulted trained educator teachers whether the participant’s condition was physically and mentally suitable (fit) to start the session. The researcher started a session with a participant only upon confirmation by the teachers.
   ii. The teachers were also requested to remind the researcher if the participant showed any kind of discomfort with or resistance to the research involvement during the activities. The researcher would stop activities immediately if that happened.
iii. Each participant was reminded of his/her rights to withdraw from any session with the teacher or the researcher whenever he/she felt to do so. This information was also provided in research information statement, which was distributed together with the consent form. The researcher requested the teachers to inform which students would be able to participate in 3 sessions or more and to exclude students who showed discomfort or unwillingness to participate.

3. During the session, there was a minimal risk for the participants. In order to prevent any potential risks:
   i. Animated social stories were presented to each participant with the use of web browser software on the tablet PC, fully supervised by the researcher.
   ii. Those participants who are not familiar with tablet PC may throw away or hit the tablet PC. This may lead to physical injuries. As a protective measure, the researcher allowed students to get used to the tablet PC through watching educational videos and playing games after getting consent from them.
   iii. Each research session only took about 8 – 15 minutes to ensure participants were at ease.
   iv. Interactive contents of social stories were presented in animations (videos) with sounds.
   v. The researcher and teachers monitored closely the changing mental state of each participant through his/her changing behaviours and facial expressions.
   vi. The researcher would take the participant with any emotional issues back to his/her class teacher immediately.
vii. The researcher would take the participant who indicated withdrawal (verbal, non-verbal signs verified by teachers) back to his/her class teacher immediately.

4. After the session, to prevent from any untoward incidents, each participant was brought back to his/her teacher immediately.

3.3.3 During Observation
The same protective measures taken in the research session were used during observation of the participants. The following were the measures adopted for observation.

1. Observation was not done in isolation. There was always a qualified teacher together with the researcher to observe the children without interrupting their daily activities.
2. Neither video nor audio was recorded to avoid interrupting the children. Only notepad and pen/pencils were used.
3. The researcher worked as an assistant in the classroom and took notes silently.
4. The researcher always consulted the teacher and asked for permission before doing anything related to children (for example: asking them to perform some activities related to stories they had learned).

The researcher would leave at once if the children showed any sign of distress.

3.4 Accountability of Research
As interventions from this research involved human participants, the observation method was very important to achieve actual results of intervention. Proper observation could increase liability of results. This study used Goal Attainment Scaling (GAS) developed by Thomas Kiresuk and Robert Sherman in 1968 to set up observation rules which were used to observe participants. Thomas Kiresuk and Robert Sherman developed GAS to evaluate a wide range of mental illnesses. Later it has been used as
standard evaluation tool in normal and special education settings (Oren and Ogletree 2000; Sladeczek et al. 2001; Ruble et al. 2012).

According to (Kiresuk et al. 1994), GAS includes nine steps which are:

1. identify issues that will be the focus of treatment
2. translate selected problems into at least three goals
3. choose a brief title for each goal
4. select an indicator for each goal
5. specify the expected level of outcome for the goal
6. review the expected level of outcome
7. specify the somewhat more and somewhat less than expected levels of outcome for the goal
8. specify much more and much less expected levels of outcome
9. repeat these steps for each goal

Based on nine steps, five scales (from -2 to +2) were needed for each goal. Zero is the expected outcome or targeted goal. -2 and -1 are somewhat less expected outcomes and +1 and +2 are somewhat more expected. The baseline is usually considered as -2 (Kiresuk et al. 1994). Importance and/or difficulty of goal should also be considered in calculating weight of goal (Turner-Stokes 2009).

\[
50 + \frac{10 \sum w_i x_i}{[(1 - \rho) \sum w_i^2 + \rho (\sum w_i)^2]^\frac{1}{2}}
\]

Equation 1  Formula for Calculating Overall Goal Attainment Scores

In the formula,

\(w_i\) = the weight assigned to the \(i^{th}\) goal
\( x_i \) = the numerical value achieved (between -2 and +2)

\( \rho \) = the expected correlation of the goal scales

According to Kiresuk et al. (1994), the approximate value of \( \rho \) is 0.3. Then the equation mentioned just now is simplified as below.

\[
50 + \frac{10 \Sigma (w_i x_i)}{[0.7 \Sigma w_i^2 + 0.3 (\Sigma w_i)^2]^2}
\]

Equation 2  Simplified Formula for Calculating Overall Goal Attainment Scores

As stated in section 3.1, dependent t-test was employed in evaluation to improve the reliability of the research. The dependent t-test is also known as paired t-test or paired samples t-test. The test is commonly used to compare the effectiveness of the interventions on the same subject (here the participant) (Laerd Statistics 2013). Brownell (2002) used this test to show the effectiveness of musically adapted social stories. To use this test, null and alternative research hypotheses are required to set. Then \( \rho \) value is calculated using t-test (paired) on two research data set. If \( \rho \) value is less than 0.05, the null hypothesis can be rejected. The null hypothesis (\( H_0 \)) and alternative hypothesis (\( H_A \)) set for this study are as follows:

**Null hypothesis (\( H_0 \))**: The effectiveness of intervention with differentiated animated social stories is the same as the effectiveness of intervention with generalised animated social stories.

**Alternative hypothesis (\( H_A \))**: The effectiveness of intervention with differentiated animated social stories is not the same as the effectiveness of intervention with generalised animated social stories.

If \( \rho \) value is greater than 0.05, \( H_0 \) has to be accepted. It means there is no significant change between the two interventions. If \( \rho \) value is less than 0.05, \( H_0 \) can be rejected.
It means there is a significant change between the two interventions. If the behaviour responses are positive in the second intervention, the effectiveness of the second intervention is better than that of the first intervention.

3.5 Research Procedures
As stated in section 1.4 and 3.1, this research mainly consisted of four phases as follows:

1. Phase 1: Domain Study
2. Phase 2: Development of Prototype and Materials
3. Phase 3: Conducting Interventions
4. Phase 4: Data Analysis

3.5.1 Phase 1: Domain Study
The first step of domain study involved reviewing literatures related to research domains which were ASD, social skills training methods and tool, social stories and differentiated instruction. Review of literature presented in Chapter 2 is the outcome of the first step of domain study (see Chapter 2: Literature Review). To better understand the nature of children who have been diagnosed with ASD, a field study was added to reinforce knowledge of ASD children derived from the literature review. The primary purpose of adding the field study was to observe children with ASD for a better understanding of these children and to find out social skills which were commonly lacking in most ASD children in school setting.

Children with ASD are more vulnerable compared to normal children. Before the field study started, researcher listed possible risks that might incur to both students and researchers, and worked out necessary measures that could be taken to manage and prevent them (see section 3.3). Then a letter was prepared to request research permission from the selected schools as mentioned in section 3.2. The letter included
details of the research including potential risks and benefits (See Appendix C Permission to Conduct Research).

After getting research approval from school, a two-school week field study was conducted in each site. As in social visits, the researcher helped as a classroom assistant and interacted with ASD children. As emerged in the review of related literature (see section 2.2), there are some social skills commonly lacking in children with ASD in school setting (Sanrattana et al. 2014). Some of them are asking for something, greeting, waiting, recognising opinions of peers and cooperating. During the field study, ASD children were observed to determine which of the social skills reflected in literature review that these participants were lacking and which would be appropriate for creating stories.

Only skills which could produce observable results were selected. Skills with observable results mean skills with a high frequency of use and skills appropriate to use in the given environment. As the research environment was school, observation was also done in the school environment. To be able to observe the result of a skill, that skill must be part of daily school lives. One good example is greeting friends which is a part of daily school live and is easily observable. The following were targeted skills to develop animated social stories.

1. Asking for Help
   A student should ask for help from teachers and/or peers if necessary. This skill is essential for learning especially in the school environment.

2. Calming Down
   A student should try to calm down if he/she is angry/sad/depressed. This is important in social communication.

3. Greeting Friends
   A student should greet his/her friends. This is basic to social communication.
4. Paying Attention

This is the skill most children with ASD lack. Attention span of ASD children is too short for them to focus something as long as normal children do. Most of them do not pay attention when someone talks to them.

5. Playing and Singing with Friends

This is an important skill in school setting. In school setting, students should play, sing and take part in the activities together. It is important to teach them how to enjoy time at school.

6. Sharing

There is a snack time at school. It is normal among friends to share their snacks during the snack time. Most ASD children do not share their snacks. It is essential to let them know how important sharing is.

7. Waiting

This is an essential skill like “Paying Attention”. This is about teaching them to wait if someone they want to talk to is busy.

There were seven skills which were commonly lacking in the ASD students from both schools. After collecting the required data, Phase 2 was proceeded.

**3.5.2 Phase 2: Development of Prototype and Materials**

At this stage, two sets of research information statement and informed consent were prepared. The first set was to invite teachers to participate in the research (See Appendix E Research Information State and Informed Consent (Teacher)). The second set was prepared to invite children with ASD together with their parents (See Appendix F Research Information State and Informed Consent (Parents & Children)).

A social skill survey form for pre-assessment was created based on the observed social skill from the field study (see section 3.5.1) and the survey form of social skill rating system (SSRS) developed by Gresham and Elliot in 1990 (See Appendix G Pre-
assessment social skill survey form). Parents/caretakers of the participants were requested to take this survey for their children. The purpose of the form was to find out the first language and social skills situation of participants from the participants’ parents/caretakers’ point of view.

Based on Goal Attainment Scales (GAS) (See section 3.4 and 4.3), an observation form was created to take down the behavioural responses of the participants by the researcher (See Appendix H Observation form).

An application called “Social Story App (SSA)" (henceforth referred to as SSA)” was developed to support integration of differentiated instruction into animated social stories. The main purpose of SSA was to aid easier differentiation process. Most of the features of SSA were based on the framework of differentiated instruction. Details of application development are presented in section 4.

Animated social stories were then designed based on the seven social skills which were observed during field study (see section 3.5.1). All those animated social stories were created in three languages: Bahasa Malaysia, English and Mandarin Chinese. Bahasa Malaysia was chosen as it is the National language and the medium of instruction in PERKATA. English was chosen given its status as the global language. Mandarin Chinese was chosen as the dominance of Chinese ethnic group in the two research sites. The detailed development can be seen in section 4.2. These animated social stories were created for children with ASD in general and were referred to as common or generalised animated social stories in this research.

After developing generalised animated social stories, observation rules were developed for each story by following the nine steps of GAS (see section 3.4) to avoid misinterpretations and to improve reliability of the research. All levels were consulted with teachers to avoid inequality between levels and ratings. The detailed observation rules can be seen in section 4.3.
After developing required materials for interventions, everything was compiled and submitted to Swinburne's Human Research Ethics Committee (SUHREC) for ethical clearance. Upon approval of the research ethical clearance, all research information statements and informed consents were distributed to teachers, children with ASD and their parents through the respective school principals as stated in section 3.2. During that time, the student researcher paid several social visits to both research sites and answered all questions related to this research.

After getting consent from participants and their parents, a simple observation and screening was conducted on participants who gave consent to check whether they met general criteria stated in section 3.2. This observation was conducted for five school days. After observation, the consented participants were filtered according to the criteria stated in section 3.2. The details of observation and screening participants can be seen in section 5.1.

### 3.5.3 Phase 3: Conduct Interventions

This phase involved four steps as stated in section 3.1. They were

1. Conducting pre-assessment
2. Investigation of the effectiveness of common/generalised animated social stories
3. Differentiation of animated social stories
4. Investigation of the effectiveness of differentiated animated social stories

#### 3.5.3.1 Conducting Pre-assessment

Pre-assessment was conducted with the ASD children who gave consent to participate in this research to find out needs, backgrounds and characteristics of the participants. Data were collected through (1) social skill survey taken by parents of the selected participants, (2) observation of the participants, and (3) informal interview with teachers. As stated in section 3.5.2, the survey was created based on the observed
social skills from field study and SSRS. Social skill survey was used to find out the first language and status of seven social skills (stated in section 3.5.2) of selected participants from their parents. Observation of the participants was conducted to confirm data collected from the social skills survey and to check the characteristics of participants. In case of dubious data, class teachers were interviewed informally. Based on findings of the pre-assessment, generalised animated social stories were assigned to participants individually inside “Social Story App”. The details of conducting pre-assessment can be seen in section 5.2.

3.5.3.2 Investigation of the effectiveness of common/generalised animated social stories

Participants were presented their assigned generalised animated social stories using “Social Story App” on a tablet computer in their free time recommended by their classroom teachers. As stated in section 3.2, each participant was presented assigned animated social stories in 10 sessions and each session took about 8-15 minutes. After the presentation, the researcher observed the participants according to observation rules (see section 4.3) and noted down their responses in the observation form (see Appendix H Observation form). Depending on the enthusiasm of participants, they were asked to perform some tasks related to their assigned animated social stories to see whether they had achieved the learning objectives. The data collected from this intervention gave a better understanding of the participants.

3.5.3.3 Differentiation of generalised animated social stories

Data collected by the previous intervention highlighted which animated social stories were effective in helping children with ASD in their social skills acquisition and which were not. This was determined by the failure rate of each generalised animated social story. A generalised animated social story was considered failed if it failed to assist 50% of assigned participants in their associated social skill acquisition. According to Sauro (2015), effectiveness of intervention can be seen through 30% of the sample size. To have better results, failure rate for generalised animated social stories were
set at 50%. At this stage, only animated social stories which were considered failed were differentiated using the findings of the pre-assessment and the first intervention with generalised social stories. Animated social stories which had more than 50% success rate were not differentiated for 2 reasons. The first reason was to avoid learning effect stated in section 3.1. The second reason was the difficulty of discerning difference between the effectiveness of generalised animated social stories which had already worked well and that of differentiated ones. As such, the next intervention made use of the differentiated version of animated social stories which failed to help the participants in their social skills acquisition in the first intervention.

After differentiating animated social stories, multiple choice question (MCQ) for those differentiated animated social stories were created to use as on-going assessment. The integration of MCQ was according to the framework of differentiated instruction (see section 2.5). Integration of MCQ helps not only teachers and parents to be able to track improvement of their children but also the children themselves as learning aids to learn better and faster.

3.5.3.4 Investigation of the effectiveness of differentiated animated social stories

In this step, generalised animated social stories were replaced with differentiated animated social stories. These were presented in 10 sessions only to participants who were formerly assigned to the generalised version of the same stories. The same procedures and presentation method as those of the first intervention were used. The difference was that after presentation, participants were asked to take on-going assessments (multiple choice questions) using “Social Story App”. Using the observation form, participants were observed and their responses were noted down. Participants were asked to do some activities related to animated social stories which they were assigned depending on their moods.
3.5.4 Phase 4: Data Analysis

Upon accomplishment of all steps of the second intervention in Phase 3, data from step 2 and step 4 of Phase 3 were compared and analysed with the following perspectives.

1. To what extent animated social stories together with tablet computer has helped the participants in learning social skills
2. What improvement has been achieved by integrating differentiated instruction

Analysing data using these perspectives ensures an alignment between research finding and the research objectives.

3.6 Summary

This chapter has presented the research methodology together with risk analysis and measures taken to manage potential risks. This has also included the research procedure taken in this research: Phase 1: Domain study; Phase 2: Development of prototype and materials; Phase 3: Conduct interventions; and Phase 4: Data analysis. The following chapter, Chapter 4 will present the development of prototype and research materials of this research.
Chapter 4: Development of Prototype and Materials

This chapter presents the details of the prototype development for this research study. This also includes how animated social stories were prepared and how observation scales of each animated social stories were set.

4.1 Prototype

Social Story App (SSA) was a simple web-based application which was constructed based on the requirements collected through field observations during the domain study stage. It was a tool designed for the teachers and researchers to conduct the social story intervention sessions with the participants.

4.1.1 Requirements

SSA was developed to achieve two main purposes: 1) to assist in differentiation processes; and 2) to be able to run on most modern devices.

1. To assist in differentiation processes

As mentioned earlier, this research investigated effectiveness of the integration of differentiated instruction into the Social Story Approach. To achieve this main purpose necessitated (1) collecting data on social skills needed by the participants via (a) social skill survey, (b) observation, and (c) informal interview as the pre-assessment for the interventions; (2) appropriately assigning generalised social stories to individual participants in the first intervention; (3) differentiating animated social stories based on the finding of the first intervention; and (4) adding on-going assessments of the students’ progress to differentiated social stories to assess the participants’ understanding of the respective social stories in the second intervention. In order to assist in differentiation processes, the following are the requirements of Story App Prototype in all the stages mentioned above.
a. Pre-assessment

As mentioned in section 1, out of 3 components involved in the pre-assessment step, a social skill survey was distributed to parents/caretakers to rate the social skill level of their children. Although distributing survey forms to parents/caretakers would not pose any problem, chances of 100 percent return of those surveys were quite slim for different reasons. If SSA were able to provide functions to create a survey form and allow parents or caretakers to take the survey online, this might solve the problems mentioned above. However, use of online survey form may pose problems for those parents/ caretakers with little or no IT knowledge/ skills or those without Internet access. It is, therefore, important to check with parents/caretakers whether using or responding to the digital social skills survey is feasible or not.

b. Differentiation

Differentiation processes in this study involved:

1. Differentiating content, modifying common animated social stories which did not work well with the participants in step 2, the first intervention mentioned in sections 3.5.3.2 and 3.5.3.3; and

2. Assigning differentiated animated social stories to participants according to needed social skills reflected in the pre-assessment stage.

While differentiating conventional social story is simple as it involves only modification of the text, differentiation of animated social story in this study is more complicated as it involves dealing with animations and videos. There is a variety of animation application software (both free and commercial) available in market which are designed for use with popular operating systems such as Windows and Mac OS X. Many of the applications are difficult for the users with limited knowledge of using computers. A great amount of time is needed to learn to use those applications. Although most
teachers are familiar with computers, those applications are still hard for them to manage. As such, SSA should meet the following requirements:

i. A simple animation tool for teachers to create/differentiate animated social stories efficiently;

ii. A feature which accepts importing other animated social stories which are created using other applications/tools for those teachers who are already familiar with certain applications/tools to create animation; and

iii. A function that allows teachers to assign specific animated social stories to specific participants.

c. Ongoing-assessment

Assessments are essential to track improvement or progress of the students. As such, SSA should have features that enable:

i. teachers to create assessments for animated social stories

ii. participants to take assessments

iii. Answers to be recorded not only for teachers, parents and learners to track improvement but also for the evaluation of the course itself.

2. To be able to run on most modern devices.

SSA is intended to be able to use on most of popular devices such as personal computers (PC), laptops, tablet PC and smart phones although this study made use of tablet PC in both interventions as the tablet can improve attention and engagement of ASD children at the time of this research (Shore & Rastelli 2006; Brandon 2011; Kim et al. 2014). The main purpose behind the idea of making SSA compactable with multiple devices is to create an opportunity for ASD children to access SSA from any popular devices they prefer.
4.1.2 Users

Users of SSA include administrator, teachers, parents or caretakers and participants. All four types can be regrouped into administrator, moderator that includes teachers, parents and caretakers, and user (participants).

1. Administrator

Administrator group has the highest authority over SSA. In other words, this group should have access to all functions of the application and is responsible for maintaining SSA.

2. Moderator

This group includes teachers, parents and caretakers. This group should have access to most functions of SSA except for system functions which are modifying/removing users and user group. All teachers have some knowledge related to computers and Tablet PC. Though most parents are familiar with the Tablet PC, some are not. AS such, either a short term training or application manual is needed to provide them to be able to operate SSA well.

3. User

This group is the direct user of SSA. The rights for this group are very clear. Members of this group should have access to watching animated social stories which are assigned to them, taking assessments related to stories and viewing results of assessments. Users of this need to know how to use the tablet at least to do the tasks mentioned above. Some participants of this study could use the tablet PC very well. In this study, those who were not used to the tablet PC were given some time to get familiar with it to avoid potential risks which are mentioned in section 3.3.
4.1.3 Quality Requirements

In addition to those requirements mentioned above, software quality standard from Consortium for IT Software Quality (CISQ) was adapted for quality assurance of SSA (Consortium for IT Software Quality 2015). The standard clearly states good practices for both coding at the unit level and architecture at the system level. The following summarises the CISQ software standard.

1. Reliability

SSA should be reliable. It means SSA should work well in the way that it is supposed to work. The resources should be managed properly to prevent any kind of abuse. All data handled by SSA should be consistent and have integrity. The error management should be implemented to notify errors recognised by the system to the point until everything is out of control.

2. Performance Efficiency

SSA should perform efficiently. To improve efficiency of application, the way of processing data should be optimized. To optimize data processing, best practices on database such as connection pooling should be applied. Data looping should be managed efficiently (for example – loop data as needed instead of looping all data at once).

3. Security

SSA should be secure enough to prevent any unauthorized action. SSA should validate any data input and check any data sent to the application. Instead of coding from sketch, popular evaluated frameworks or libraries with desired features should be implemented.

4. Maintainability
SSA should easily be maintained. Proper measures such as proper documentations, consistent logic, dynamic coding and removing unnecessary parameters can increase maintainability of the application.

Besides software quality, cost of SSA is another factor to be considered. If SSA were good enough to help differentiation, cost of the application should be efficient or reasonable enough for schools and parents in a long run. It should be either free of charge or at the amount that even less fortunate people can afford.

4.1.4 Use Cases

As mentioned in section 4.1.2, there are three user groups (administrator, moderator and user) as an outcome of regrouping four user types (administrator, teachers, parents/caretakers and participants). Use case diagram should be one diagram including all actors. However, as there are many use cases for the two groups, the administrator group and the moderator group, use case diagrams are split into 3 groups and presented accordingly: (1) the administrator group’ s use case diagram (see Figure 3); (2) the moderator group’s use case diagram (see Figure 4); and (3) the user group’s use case diagram (see Figure 5).

The use case of the administrator group is illustrated in Figure 3.
As can be seen in the given figure, login is required for all user groups to perform any operation of SSA. As can be seen in the figure, the group has access to all features of SSA. However, members of the administrator group are responsible only for the administration of SSA.

Figure 4 below illustrates use cases of the moderator group. Compared with the administrator group, the only functions which cannot be accessed by this group are the functions related to the user group. All the rest are the same as those of the administrator group. The major functions that they have access to are related to (1) user whereby they can view the user list, edit user by creating new users or deleting existing users from the list; (2) social story whereby they can view the social story list, edit social story by creating a new social story or by deleting current social stories and assign social stories to users; (3) assessment whereby they can view the result list and edit assessment by creating new assessment or deleting existing assessments; and (4)
assessment result whereby they can see the result list and view the results of the individual user(s).

Figure 4 Use case diagram of the moderator group

Figure 5 Use case diagram of the user group
Figure 5 provides the use case diagram for the user group which has least access to SSA among three groups. Although some functions available to this group look similar to those of other groups, the level of authority and the panel from which they access are different. It is explained in section 4.1.5 and section 4.1.6.

### 4.1.5 Main Processes

Figure 6 shows the main processes of SSA. To start using SSA, a browser and an internet connection are needed. The web address of SSA is to be entered in the browser. The landing page of SSA is “Login” page which requires all users to provide email address and password. This prevents anyone unauthorised from using or having access to SSA. Logging on using email address and password enables SSA to proceed to check credentials. If either of the credentials is blank, an error message appears under the login container, informing which credential is required to fill. SSA also checks the format of email address to assure formatting. If credentials are not correct, an error message “Invalid Email Address & Password” is displayed under the login container. If the login credentials are correct, SSA proceeds with checking whether this user has access to the administrator panel. If a user has no access to administrator panel (which is commonly known as backend), he/she is redirected to Dashboard page of the user panel (which is commonly known as frontend). If he/she has access to backend, SSA brings him/her to “Dashboard” page of backend. The idea of splitting two panels is to reduce users’ confusion.
The backend consists of 6 elements: “Social Story”, “Assessment”, “Result”, “User”, “User Group” and “Logout”. There is a main menu which can be used to access those elements. The menu can also be accessed easily from any of those elements. “Pre-assessment” was left out from SSA because it was hard to find the right time to train parents to take the surveys. As stated in section 3.5.3.1, it was decided to use the conventional way to conduct the “Pre-assessment”, that is, hard copy survey forms were distributed to participants through class teachers. “Social Story” includes listing, searching, creating, assigning, editing and deleting of animated social stories. “Assessment” has features for listing, searching, creating, editing and deleting. Only viewing can be done in “Result” in order to avoid accidental editing of results of users. “User” and “User Group” have the same features which are listing, searching, creating, editing and deleting features in “Assessment. “Logout” is a feature that allows the user to log out of SSA and to be redirected to “Login” page.

The frontend includes “Social Story”, “Assessment”, “Result” and “Logout”. The frontend has a main menu which works in the same way as the backend does: having access to all elements and being accessible from any element. “Social Story” has features of listing, searching and viewing. “Assessment” includes features of listing,
searching and taking. As in backend, “Result” has only one function: viewing. “Logout” here works in the same way as that in the backend.

4.1.6 User Interface Designs

Interface designs for SSA were constructed based on requirements and use case diagrams. As mentioned in section 4.1.5, there are two panels which are frontend and backend. Designs of both panels are presented in Figure 8 and Figure 9. There is only one login page for both backend and frontend. Users have to provide email address and password for SSA login as can be seen in Figure 7.

![SSA's login page](image)

Figure 7 SSA’s login page

According to the permissions granted to users, they are directed either to backend or frontend. Errors regarding login credential are displayed under the login button. After logging out from any panel, users are redirected to the Login page again.

Figure 8 below illustrates the dashboard page for SSA backend. This is also the landing page for users with backend access after logging in. There is a text logo at the right top of screenshot. Below the logo, the user name together with the user profile picture is displayed. A vertical menu is placed after the user name. The menu item of the current page (“Dashboard”) is highlighted. This frame is a typical frame for most pages in backend.
Figure 8 Dashboard page of SSA backend

Figure 9 Social Story page of SSA backend

Figure 9 portrays the page for social story of SSA backend which can be reached by clicking “Social Story” from menu. A list of animated social stories available on SSA is presented. As can be seen, the list style is the same for all other elements such as assessment, result, user and user group. As mentioned in section 4.1.1, animation creation is not enough and uploading function should be integrated for users who may want to use other animation tools. As such, an extra function, “Create Social Story Animation” is added beside “Upload Social Story Video”. Under “Action”, there are three main functions: assigning, editing and deleting. Assigning allows the moderator user to assign a particular story to users. Editing enables users to edit particular social stories and deleting to remove social stories from SSA. There are search and pagination functions after the listing.
Figure 10 demonstrates the page for creating animation. User is directed to this page upon clicking “Create Social Story Animation” from the social story listing page. The drawing board for animation is linked to the button “Open Animation Tool”. Although it is better to place the tool on the same page, the page is not big enough to display the drawing board clearly. The drawing board wireframe is provided in Figure 11.

The animation tool is a simple drawing board with sequences of frames. Users can draw frame by frame, running the entire frame results in animation. Some basic shapes are provided on the left side of the drawing board. Media such as pictures and audio files can be inserted. After finishing animation, clicking on the save button (floppy disk icon) allows saving it as a bunch of codes and returning to the previous page (Figure
10) where users can click either “Create” to save the animation or “Cancel” to discard it.

As mentioned earlier, there is an “Upload Social Story Video” function next to “Create Social Story Animation”. Uploading a pre-made animation video is much simpler than creating animation which is displayed in Figure 12.

Figure 12 can be reached by clicking “Upload Social Story Video” from the social story list page. Users need to enter the title, choose a file to upload via “Browse” and then click “Create”. It takes a while to upload video depending on the size of video and upload speed.

![Figure 12: Upload Social Story video page for SSA backend](image)

Editing interfaces for the social story are the same as creating. If the story that the user would like to edit has been created using animation function, editing interfaces are the same as Figure 10 and Figure 11. If it is done by uploading, editing interface is the same as Figure 12.

The screenshot of the assessment page of SSA backend is demonstrated in Figure 13. This page can be navigated via “Assessment” from the menu. “Create Assessment” button is linked with the page to create assessment. The assigned function is not included in the assessment. Search and pagination are also the same as other pages.
Figure 13 Assessment page of SSA backend

Figure 14 here represents the “Create Assessment” page of SSA backend. This is accessible to the moderator group (and the administrator).

There is nothing much SSA can help in assessments which are meant only for users who can read. For example, text-based multiple choice questions are troubles for participants who cannot read. Even if the teacher reads for them, it is still hard for them to choose the answer in text. If the pictures were provided (as practised in the class room where they are asked to choose pictures), these pictures might be interpreted wrongly because most social stories are action-based (example; greeting friends) and simple static pictures might not work for them. If SSA can provide the assessment with audio question and moving pictures choices (Graphics Interchange Format - GIF), it may be able to compensate for the weaknesses mentioned above. Bearing in mind the difficulties that learners who do not know how to read may have and problems with interpreting pictures, wireframe for assessment is designed as illustrated in Figure 14. This page allows the user to create questions both in text and audio, and choices available are GIF type pictures. This also allows to set or link these question to the associated social story that these questions assess. The social story can be chosen from the list. The same interface is used for editing assessments.
Figure 14 Create Assessment page of SSA backend

Figure 15 Result page of SSA backend

Figure 15 displays the result page. The list shows assessment of stories that have been taken, marks and user names of those who have taken. The details of each can be viewed by clicking document icon under “Action”. The detailed result page is provided in Figure 16. As can be seen in Figure 16, this page includes the title, user name, starting time and finishing time of the assessment. The total mark is calculated based on the correct responses provided in all assessments given in a particular story that is taken.
The user page of SSA backend is provided in Figure 17. The list mentions ID, name, email address and user group. Search and pagination are provided. Users can be created, edited and deleted through this page.

Refer to Figure 18 for the page “Create user”. Editing in this page functions in the same way as creating user does.
Figure 18 Create User page of SSA backend

Figure 19 demonstrates the user group page for SSA backend. All features are the same as the user page.

SSA also allows grouping of the users. Create user group page includes user group name and permission lists (Figure 20). To increase flexibility in grouping users, permissions are added for every function. The wireframe includes sample permissions and the actual permission list has more permission types than these samples. In
addition to 3 user groups (administrator, moderator and user), user group with any name and any permission can be created. As usual, interface for editing is the same.

Figure 20 Create User Group page of SSA backend

When the users who do not have access to the backend log in, they are directed to the dashboard page of the frontend. Figure 21 is the landing page for users who do not have access to the backend after logging in. The design of the frontend is significantly different from that of the backend. As the frontend is meant for presenting animated social stories and assessments, it needs more space than the backend does. As a result, the menu is moved from the regular space, the left side, to the top in the frontend page. The logo is presented as text in the upper right corner as in the backend. Right after the logo, the main menu starts. The menu includes “Dashboard”, “Social Story”, “Assessment”, and “Result”. The user name of the current user is displayed at the top right corner under which there is a dropdown menu which includes “Profile” and “Logout”.

Figure 21 Dashboard page of SSA frontend

Figure 22 demonstrates the Social story list page. The list includes titles, the name of user who creates/uploads the stories and a button for viewing stories. The listing is different from that of the backend. The list here shows only stories which are assigned to the current login user. Clicking “view” directs the user to the respective social story page to view it.

Figure 22 Social Story page of SSA frontend

Figure 23 illustrates the individual story view. The feature here allows the user to view the video in full-screen mode. Below the video screen are the two buttons, “Social Story List” and “Assessment”. The “Social Story List” button takes the user to social story list page whereas the “Assessment” button directs the user to assessments
associated with that story. If there is no assessment available for this story, the “Assessment” button is disabled, that is, that button cannot be clicked.

![Image of Social Story App](image.png)

Figure 23 View Social Story page of SSA frontend

Given the different functions of the users, the assessment listing page of the frontend is also different from that of the backend. As can be seen in Figure 24, a list of social story is presented instead of assessment list because of the possibility of having more than one assessment associated with one story. The list of story in assessment page only shows assessments associated with assigned stories. Assigned social stories without assessments are excluded from the list. The stories in the list are connected with all associated assessments. Once the user chooses a story, he/she has to take all assessments associated with that particular story. This will enable the users to take all assessments related to a particular story without having to be worried about missing any assessments of that particular story.
Figure 24 Assessment page of SSA frontend

Figure 25 below demonstrates the page the user is directed to upon clicking “Take” under “Action”. This sample page provides assessments listed for the animated social story 01. There are three buttons at the bottom: “Previous”, “Next” and “Submit”. “Previous” allows users to go back to the previous assessment if there is any. The button is in disabled mode if there is no previous assessment. In the same way, the “Next” button enables users to proceed to the next assessment if there is any. If there is none, the “Next” button is disabled. “Submit” button is disabled until all assessments are attempted.
Figure 26 portrays the result page. The listing shows the story titles, date and time of taking assessment and marks scored. The detailed result can be viewed by clicking the “View” button.

![Figure 26 Result page of SSA frontend](image)

The detailed result page is similar to the detailed result page of the backend presented in Figure 27.

![Figure 27 View Result page of SSA frontend](image)

### 4.1.7 Database

There are different types of data which SSA needs to store and retrieve efficiently when they are needed. Some data such as animated social stories and pictures can be saved as files within SSA. Even though those files can be stored easily, SSA needs to
have the location of the files and some data related to the users cannot be stored in such a way. If the user data were saved in the text files, this would not allow us to retrieve and modify the data efficiently. This is where the database plays the main role.

The database design was developed based on all the requirements. The objects related to SSA are social story, assessment, result, user and user group. One more table is added to assign social stories to appropriate user(s). The database design can be seen in Figure 28.

![Figure 28 Entity Realionship Diagram (ERD) for SSA](image-url)
After settling the environment, database was prepared. Below are SQL codes which are based on the database design. A new table named “session” was added for security purpose according to CodeIgniter’s suggestion (CodeIgniter 2014).

```sql
/*Drop Tables*/
DROP TABLE IF EXISTS result;
DROP TABLE IF EXISTS assessment;
DROP TABLE IF EXISTS assignment;
DROP TABLE IF EXISTS social_story;
DROP TABLE IF EXISTS user;
DROP TABLE IF EXISTS user_group;
DROP TABLE IF EXISTS session;
```

Figure 29 SQL codes for dropping tables

Figure 29 shows SQL codes for dropping tables. Sometimes, people may not be aware of pre-existing tables in the database. As a precaution, tables which are going to be created are to be checked against the database to see whether they are already in the database and drop them if they exist.

```sql
/*Session*/
CREATE TABLE session(
    session_id VARCHAR(40) DEFAULT 'O' NOT NULL,
    ip_address VARCHAR(45) DEFAULT 'O' NOT NULL,
    user_agent VARCHAR(129) NOT NULL,
    last_activity INT(10) unsigned DEFAULT 0 NOT NULL,
    user_data TEXT NULL,
    PRIMARY KEY (session_id),
    KEY `last_activity_idx` ('last_activity')
)ENGINE = InnoDB DEFAULT CHARACTER SET = utf8 COLLATE = utf8_unicode_ci;
```

Figure 30 SQL codes for creating 'session' table

The SQL codes mentioned in Figure 30 are meant for creating 'session' table. This table was added according to the security measure of CodeIgniter. It stores IP address, browser type and last activities of the user who are using SSA. The ‘user_data’ column is there for the developer to store any user data as a reference throughout the session until the users log out. In SSA, the user data which includes profile data and permissions are stored inside the column to validate permissions across SSA. All tables are set to utf-8 which supports most of the language characters.
Figure 31 provides SQL codes for the ‘user_group’ table. This table is responsible for grouping users according to the permission. Each feature of SSA has permission for flexible grouping instead of static grouping with hard codes.

```sql
/*User Group*/
CREATE TABLE user_group(
    user_group_id INT(6) AUTO_INCREMENT,
    user_group_name VARCHAR(255) NOT NULL UNIQUE,
    permission_backend_access INT(1) DEFAULT 0,
    permission_user_group_access INT(1) DEFAULT 0,
    permission_user_group_create INT(1) DEFAULT 0,
    permission_user_group_delete INT(1) DEFAULT 0,
    permission_user_access INT(1) DEFAULT 0,
    permission_user_create INT(1) DEFAULT 0,
    permission_user_edit INT(1) DEFAULT 0,
    permission_user_delete INT(1) DEFAULT 0,
    permission_social_story_access INT(1) DEFAULT 0,
    permission_social_story_create INT(1) DEFAULT 0,
    permission_social_story_edit INT(1) DEFAULT 0,
    permission_social_story_delete INT(1) DEFAULT 0,
    permission_assessment_access INT(1) DEFAULT 0,
    permission_assessment_create INT(1) DEFAULT 0,
    permission_assessment_edit INT(1) DEFAULT 0,
    permission_assessment_delete INT(1) DEFAULT 0,
    permission_result_access INT(1) DEFAULT 0,
    permission_result_create INT(1) DEFAULT 0,
    permission_result_edit INT(1) DEFAULT 0,
    permission_result_delete INT(1) DEFAULT 0,
    PRIMARY KEY (user_group_id)
)ENGINE = InnoDB DEFAULT CHARACTER SET = utf8 COLLATE = utf8_unicode_ci;
```

Figure 32 provides SQL codes for the ‘user’ table. The table stores user data which include image(s), email address, password, name, gender, date of birth (dob), biography and group to which the user belongs.

```sql
/*User*/
CREATE TABLE user(
    user_id VARCHAR(6) NOT NULL,
    user_image VARCHAR(128) NOT NULL DEFAULT "default.png",
    user_email_address VARCHAR(128) NOT NULL UNIQUE,
    user_password VARCHAR(128) NOT NULL,
    user_name VARCHAR(50) NOT NULL,
    user_gender INT(1) NOT NULL,
    user_dob DATE NOT NULL,
    user_biography LONGTEXT NOT NULL DEFAULT ",",
    user_group INT(6) NOT NULL,
    PRIMARY KEY (user_id),
    FOREIGN KEY (user_group) REFERENCES user_group(user_group_id)
)ENGINE = InnoDB DEFAULT CHARACTER SET = utf8 COLLATE = utf8_unicode_ci;
```
Figure 33 SQL codes for creating 'social_story' table

SQL codes of 'social_story' table are provided in Figure 33. This table is responsible for the social story. It saves time of social story created/updated, the title, the user who creates/uploads, 'social_story_json' for animation and 'social_story_video' for video file link. Animation is saved in codes rather than video.

Figure 34 SQL codes for creating 'assignment' table

Figure 34 states SQL script for 'assignment' table. This table is associated with another two tables which are 'user' and 'social_story' to record assignments of social stories to users.

Figure 35 SQL codes for creating 'assessment' table

Figure 35 presents SQL codes of 'assessment' table. This table is connected with the 'social_story' table. One social story can have more than one assessment. Assessment question is stored in two formats which are text and audio. The 'assessment_answer'
column is for the link of the image of the correct answer to the respective assessment. The ‘assessment_choice’ stores image links of four multiple choices. In fact, the original plan was to have a dynamic number of multiple choice. The interface of ‘assessment’ is not flexible enough to display dynamic numbers of images. Finally, it was decided to keep four choices. ‘assessment_social_story’ stores ID of related social story.

/*Result*/
CREATE TABLE result(
paper_id INT(11) AUTO_INCREMENT,
paper_start_time DATETIME NOT NULL,
paper_end_time DATETIME NOT NULL,
paper_answer TEXT NOT NULL,
paper_total_mark INT(2) NOT NULL,
paper_social_story INT(11) NOT NULL,
paper_candidate VARCHAR(5) NOT NULL,
PRIMARY KEY (paper_id),
FOREIGN KEY (paper_social_story) REFERENCES social_story(social_story_id),
FOREIGN KEY (paper_candidate) REFERENCES user(user_id)
)ENGINE = InnoDB DEFAULT CHARACTER SET = utf8 COLLATE = utf8_unicode_ci;

Figure 36 SQL codes for creating 'result' table

Figure 36 lists SQL codes for 'result' table. This table is responsible for storing results of the users. Results include starting time, ending time, answers of paper(s) together with question(s), total mark, associated social story and the candidate. One result may contain more than one answer if the story has more than one assessment. Total mark is calculated based on the number of assessments which are linked with the social story that has been taken. If there were two assessments for a certain story and the user had one of them correct, the total mark would be 50 marks. All SQL codes were merged into one SQL script and imported into MySQL database using phpMyAdmin which is management software for MySQL.
Figure 37 Database configuration of SSA

Figure 37 is database configuration of SSA. It is inside a file named “database.php” under application/config folder of CodeIgniter. This is the configuration file which is used to connect between MySQL server and CodeIgniter. Username, password and database credentials are sample data and the actual credentials are changed to unpredictable credentials for security purpose. MySQLi is used for database driver instead of MySQL. MySQLi is the improved version of MySQL and it has many advantages over MySQL. Some of advantages include being dual object-oriented, ability to prepare statement which can prevent SQL injection, supporting multiple statements and supporting transactions which can roll back a whole group of queries if one of them fails (Mark on PHP 2014; Johnson 2014).

4.1.8 Platform

One of the purposes of developing SSA is to be able to run on most of the popular devices. The targeted devices are personal computers (PC), laptops, tablet PCs and smart phones. Although the smart phone is not recommended for presenting animated social stories to children due to its small screen size, it is still taken into consideration.

General operating systems running on targeted devices are Windows, Mac OS X, Linux, iOS and Android. There are two ways to deploy SSA in all those operating systems. One of them is to develop native application for each operating system. This kind of deployment poses some problems. First of all, it takes more time to develop.
One application for each operating system is to be developed as software development kits are not the same for each operating system. Due to differences in software development kits, user interfaces are also different. This may annoy some users who use two or more devices with different operating systems.

Another way of deployment is developing SSA as a web-based application, a platform which can be accessed from all those operating systems. Web-based applications are getting popular nowadays for several reasons. Firstly, no software is needed to install because applications can be accessed via browser which is a pre-installed application in most of the operating systems. Secondly, user interfaces of application are also the same for all operating systems. Thirdly, developing SSA as a web-based application can address the CISQ software standard. Fourthly, web-based applications are reliable. All error management can be implemented to the point until the application is not responding. More importantly, web applications are very efficient and they can be run on devices with low specifications. Many plugins, frameworks and libraries which are secure and open-source are available for web application development. Web applications are also easy to maintain and update. Financially, except for the server fee, there is no additional charge for users.

4.1.9 Framework

SSA is a web application based on PHP, jQuery and MySQL database. There are many famous PHP frameworks available for normal web-based application. Some among them are Laravel, CodeIgniter and CakePHP (A Nerdy Mom 2012; Jonathan 2013; Smith 2014). Each of them has its own pros and cons.

With Laravel, the application can be built block by block (high modularity) and template engine is quite easy to use. The drawback of Laravel is its development environment. Setting development environment is quite hard and the hardware requirements are slightly high.
The most impressive point of CodeIgniter is its supports. The official website provides a documentation which is comprehensible, clear and very well-maintained. It also has a support forum with active members. It is also very easy to setup. The main downside of CodeIgniter is low modularity as opposed to Laravel.

Databases queries are extremely easy in CakePHP. It has a huge community like CodeIgniter. The drawback is its slow performance.

Out of three PHP frameworks, CodeIgniter was chosen for SSA because of its supports and performance. Strong supports can tackle some of software requirements which are reliability, security and maintainability. Firstly, its excellent documentation can guide developers to best approaches. If any well-known issue is encountered during development, appropriate measures regarding that issue may have already been discussed on its strong community forum. Even if the issue has not been discussed yet, the developer can post it on the forum and active members there are ready to help. CodeIgniter is a light-weight framework and its performance is really good. It is also portable.

After reviewing PHP frameworks, it becomes clear that an additional plugin is needed for animation feature which is not supported by PHP framework. There are two choices of online animation which are Flash and HTML5.

Flash animation using ActionScript was the primary choice before Apple stopped providing flash content on iOS and Steve Jobs explained the reason of barring flash (Jobs 2010). Later in 2011, Adobe also announced that there would be no more Flash for Android and BlackBerry (Patel 2011). It means choosing Flash is not the wise choice for multi operating system compatibility of SSA.

Another choice is HTML5 which is getting popular although it is still in recommendation state (W3C 2012). HTML5 Canvas can be used for drawing and animation. There are many libraries already available for HTML5 Canvas. Some of popular libraries are
EaselJS, KineticJS and Fabric.js. There are not many reviews but tutorials to try them. API of EaselJS is very similar to ActionScript. It provides object nesting and consists of a full hierarchical display list. The main problem with EaselJS is that it does not support Internet Explorer which is lower than version 9. KineticJS works the same way as EaselJS, but Eric Rowell who is the developer of KineticJS stopped developing KineticJS (KineticJS 2014). Unlike the previous two libraries, Fabric.js supports SVG parser and the older version of Internet Explorer. It also provides excellent documentations and tutorials. This makes it easier to choose one of them. Fabric.js was chosen to develop animation feature of SSA.

To sum up, SSA developed for this study is a web application based on CodeIgniter framework where Fabric.js is integrated for animation feature. The next part is preparation and implementation of MySQL into CodeIgniter.

4.1.10 Environment

After choosing framework and plugin, the environment for SSA was planned. The required environment is a normal web server which supports at least HTML, jQuery, Javascript, PHP and MySQL.

For development environment, a local web server is enough. There are many applications available (such as XAMPP and WAMP) to create a local web server. Between XAMPP and WAMP, it is hard to decide which one is better. It depends on the developers and applications which are going to be developed. For SSA, both of them are convenient because there are not many requirements. In addition, the WAMP package is smaller than that of XAMPP and resource consumption is quite low. Thus, WAMP was chosen for development environment.

The actual environment for running SSA needs a web address (whether domain or subdomain) in addition to a web server. Any web hosting (both free and paid) can be used to run SSA. SSA may have problems with some web hosting companies due to
disk space limit and upload limit. It depends so much on users. The required disk space to run SSA is 5 Megabytes. The size is getting bigger as users are either creating animation or uploading videos. Some web hosting companies limit the size of upload file. In order to avoid those possible risks, a virtual private server (VPS) which is self-managed is used for this research. On self-managed VPS, disk space and limits can be managed by the researcher himself. The specification of server is presented in Table 3.

Table 3 Specifications of server

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU</strong></td>
<td>Intel(R) Xeon(R) E5-2620 v2 @ 2.10GHz</td>
</tr>
<tr>
<td><strong>RAM</strong></td>
<td>3 Gigabytes</td>
</tr>
<tr>
<td><strong>Hard Disk</strong></td>
<td>75 Gigabytes</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>3 Terabytes</td>
</tr>
</tbody>
</table>

As SSA is meant for teachers, parents and children diagnosed with ASD, getting feedback from users is significant. Section 4.1.11 below provides feedback from users on SSA on the usability of SSA.

4.1.11 User Feedback

Two teachers and four students who have some prior knowledge on using information technology for teaching and learning from both schools were asked to test SSA on different platforms i.e. Windows desktop computer and Android tablet computer.

As SSA is intuitive, teachers were able to use it well. According to feedback from teachers, SSA was easy to use. But there were some problems with animation feature. One of the teachers mentioned that creating animation was easy but it required a great skill of painting to get a good animation. Drawing board of SSA is a basic tool with no effect at all. The teacher suggested including ready-made animation characters which can be dragged and dropped instead of drawing them. Another teacher raised another
problem in uploading pre-made animation video. The teacher tried to upload video with FLV extension and SSA showed an error of rejection because SSA only accepted video with MP4 format to be compatible with browsers from mobile operating systems for upload. The teacher mentioned that it is hard for her to convert the file type.

Students were able to use SSA but they still needed help from teachers in some cases such as logging in and taking assessments. Some of them still needed some more time to get familiar with tablet PCs. Some of them seemed to have high motivation of using tablet.

4.2 Animated Social Stories

Common animated social stories were created as stated in section 3.5.1 and section 3.5.2. During the domain study, a field study was conducted in both schools whereby the researcher helped as a classroom assistant and interacted with ASD children to determine which social skills reflected in literature review that they did not have and which would be appropriate for creating stories. A total of seven social skills were identified and selected to create animate social stories based on the field study. They were Asking for Help, Calming Down, Greeting Friends, Paying Attention, Playing and Singing with Friends, Sharing and Waiting.

After deciding targeted social skills, story lines for targeted social skills were developed. (Refer to section 2.4 for the guideline of developing social stories.) According to Gray & Garand (1993), it is suggested that 0 to 1 directive sentence should be used with 2 to 5 descriptive sentence. Based on the suggestion, the social stories in this research project were constructed with two descriptive sentences per directive sentence. Some story lines came from observation, literature reviews and online sources. Based on data collected from consultation with teachers, story lines were modified to fit the school setting. The modified story lines resemble scripts more
because those were modified for animation. Extra sentences were added to demonstrate skills together with situations.

1. Asking for Help

This script came from observation. In school, students were encouraged to put up their hands when they would like to ask teacher for help. This story explains how to ask for help from teachers. Script was written to describe the situation in which the student needs to ask for help and the responses associated with this situation. The script for this story is presented below in Table 4. Refer to Figure 38 for the screenshots of the story “Asking for Help.”

Table 4 Script of “Asking for Help”

<table>
<thead>
<tr>
<th>Asking for Help</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hello! My name is Daniel.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>If I need help, I can ask my teacher for help.</td>
<td>Directive</td>
</tr>
<tr>
<td>I call my teacher and raise my hand.</td>
<td>Directive</td>
</tr>
<tr>
<td>When she is ready to help me, she will call me.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Daniel: Teacher! Teacher! (Raising hand)</td>
<td>Demonstrating situation in animation</td>
</tr>
<tr>
<td>Teacher: Yes? Daniel</td>
<td>Control</td>
</tr>
<tr>
<td>Remember! Raise hand and ask teacher for help.</td>
<td>Control</td>
</tr>
<tr>
<td>Thank you very much.</td>
<td>Descriptive</td>
</tr>
</tbody>
</table>

Figure 38 Screenshots of "Asking for Help"
2. Calming Down

During observation, some ASD children were observed to have tantrums easily when they were forced to do something they did not like. They did not stop throwing tantrums until teachers tend to them. Sometimes they were persistent and kept crying/angry even though teachers tried their best to calm them down. The story presents the situation and explains to the user how to calm down. The script provided in Table 5 was adapted from a video (katrinaross33 2011) to suit the school setting. See Figure 39 for the screenshots of “Calming Down”.

Table 5 Script of “Calming Down”

<table>
<thead>
<tr>
<th>Calming Down</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hello! My name is Daniel.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Sometimes I feel angry.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Sometimes I feel confused.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>At that time, I need to take a deep breath.</td>
<td>Directive</td>
</tr>
<tr>
<td>I can count one to ten.</td>
<td>Directive</td>
</tr>
<tr>
<td>One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Ten</td>
<td>Demonstrating of counting one to ten</td>
</tr>
<tr>
<td>When I feel calm, I will talk to the teacher about what made me angry or confused.</td>
<td>Directive</td>
</tr>
<tr>
<td>She can help me solve the problem.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>This will help me feel better.</td>
<td>Perspective</td>
</tr>
</tbody>
</table>

Figure 39 Screenshots of “Calming Down”
3. Greeting Friends

In schools, students are encouraged to greet their teachers and friends when they step into the classrooms. They are encouraged to greet passionately to each other. This story shows how to greet properly to enhance interaction. This script of the story was adapted from Mandasari (2012). The script of “Greeting Friends” is presented in Table 6. Figure 40 offers the screenshots of the story “Greeting Friends”.

<table>
<thead>
<tr>
<th>Greeting Friends</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hello! My name is Daniel.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>I am going to show you how to greet friends.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>When I see my friend, I look at him or her.</td>
<td>Directive</td>
</tr>
<tr>
<td>I smile and wave my hand.</td>
<td>Directive</td>
</tr>
<tr>
<td>I say “Hi” and call his or her name.</td>
<td>Directive</td>
</tr>
<tr>
<td>Her name is “Jenny”. She is my friend.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>This is how to greet friend.</td>
<td>Affirmative</td>
</tr>
<tr>
<td>Thank you very much.</td>
<td>Descriptive</td>
</tr>
</tbody>
</table>

Figure 40 Screenshots of “Greeting Friends"
4. Paying Attention

This story was picked up from observation. During observation, it was found out that many children were not paying attention when teachers talked to them. Losing attention made them miss instructions or misinterpret the instructions. Teachers usually asked them to look into their faces when they gave important instructions. Like other stories, the screenshots of the story “Paying Attention” are presented in Figure 41.

Table 7 Script of “Paying Attention”

<table>
<thead>
<tr>
<th>Paying Attention</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hello! My name is Daniel.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>When the teacher or my friends talk to me, I should pay attention carefully.</td>
<td>Directive</td>
</tr>
<tr>
<td>I look at my teacher’s face.</td>
<td>Directive</td>
</tr>
<tr>
<td>I do not look all around.</td>
<td>Directive</td>
</tr>
<tr>
<td>The teacher and my friends will be very happy if I pay attention carefully.</td>
<td>Perspective</td>
</tr>
</tbody>
</table>

5. Playing and Singing with Friends

Students were encouraged to join activities in schools. They were usually asked to sing together. Some of them did not sing together unless they were asked individually. Some of them were forced to play in group. The story tells the viewer how singing and playing together is great fun. The story lines were adapted from Mandasari (2012) with
the replacement of “study” for the word “work”. Table 8 below provides the script of the story “Playing and Singing with Friends” while Figure 42 portrays the screenshots of the story.

Table 8 Script of "Playing and Singing with Friends"

<table>
<thead>
<tr>
<th>Playing and Singing with Friends</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>At school, I can do a lot of things.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>I can study, I can play and I can sing too.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>I can play with my friends and we can sing together.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Playing and singing with friends is a fun thing to do.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>My friend and I will be happy when we are playing or singing together.</td>
<td>Perspective</td>
</tr>
</tbody>
</table>

Figure 42 Screenshots of "Playing and Singing with Friends"

6. Sharing

Sharing is one of the basic social skills. During observation, only a few students were willing to share their snacks with friends and teachers but many were not. Some of them simply ignored teachers’ instructions to share their snacks. The story explains how to behave at snack time and how to share with friends. This story line were also adapted from Mandasari (2012) with some changes made. Refer to Table 9 for the script and Figure 43 to for the screenshots of this story.
Table 9 Script of "Sharing"

<table>
<thead>
<tr>
<th>Sharing</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>We have snack time at school.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Friends talk and share at snack time.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Some friends greet me “Hi!”</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Some friends ask for drink.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Some friends ask for more snacks.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>I can say “Hi!” to my friends.</td>
<td>Directive</td>
</tr>
<tr>
<td>I can ask for more snacks.</td>
<td>Directive</td>
</tr>
<tr>
<td>Friends are happy when we talk and share at snack time</td>
<td>Perspective</td>
</tr>
</tbody>
</table>

Figure 43 Screenshots of "Sharing"

7. Waiting

This is another common skill which is lacking in children with ASD in this study. During observation, some children simply could not wait until their teachers were free. A few of them could not wait for their turn and rushed to their teachers. This story presents the situation and explains how to wait properly. The story was adapted from a YouTube video (lauchunyin1991 2012). Table 10 provides the script and Figure 44 the screenshots.
Table 10 Script of "Waiting"

<table>
<thead>
<tr>
<th>Waiting</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hello! My name is Daniel.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>I should wait when someone I want to talk is busy</td>
<td>Directive</td>
</tr>
<tr>
<td>Now the teacher is talking to another student.</td>
<td>Referring to sense in animation</td>
</tr>
<tr>
<td>I should not talk to the teacher straight away.</td>
<td>Directive</td>
</tr>
<tr>
<td>I should wait until the teacher is free.</td>
<td>Directive</td>
</tr>
<tr>
<td>While I am waiting, I should remain silent or I can do something useful that will not disturb them.</td>
<td>Directive</td>
</tr>
</tbody>
</table>

Figure 44 Screenshots of "Waiting"

4.3 Goal Attainment Scales (GAS)

Following the steps of GAS (see section 3.4), five scales for each story were defined as follows. Importance and difficulty of stories were decided based on literature review and observation. All levels were consulted with teachers to avoid inequality between levels and ratings.
<table>
<thead>
<tr>
<th></th>
<th>much less than expected (-2)</th>
<th>less than expected (-1)</th>
<th>expected (0)</th>
<th>more than expected (+1)</th>
<th>much more than expected (+2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asking for Help</strong></td>
<td><strong>bad moods</strong></td>
<td>do nothing</td>
<td>raise hand (or) call teacher</td>
<td>raise hand and call teacher and ask for help politely (or) give signals to teacher in proper manner non-verbally</td>
<td></td>
</tr>
<tr>
<td><strong>Importance = 3,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Difficulty = 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Calming Down</strong></td>
<td><strong>bad moods</strong></td>
<td>calm down when teacher/assistant/ caretaker interacts with him/her</td>
<td>partially control emotion (take a deep breath or count 1 to 10)</td>
<td>control emotion properly (take a deep breath and count 1 to 10)</td>
<td>control emotion properly and explain to teacher/parent/caretaker</td>
</tr>
<tr>
<td><strong>Importance = 3,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Difficulty = 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Greeting Friends</strong></td>
<td>ignore/ become aggressive when he/she is asked to greet</td>
<td>a little hard to greet even he/she is asked</td>
<td>greet when he/she is asked to do</td>
<td>greet friends without being asked</td>
<td>greet friends with good expressions (smiling or waving hand or both)</td>
</tr>
<tr>
<td><strong>Importance = 3,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Difficulty = 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Paying Attention</strong></td>
<td>totally ignore</td>
<td>need to remind frequently to pay attention</td>
<td>pay attention when he/she is asked to do</td>
<td>pay attention on his/her own</td>
<td>pay attention and respond properly</td>
</tr>
<tr>
<td><strong>Importance = 3,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Difficulty = 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Playing and Singing with Friends</strong></td>
<td>ignore/refuse to play with friends even he/she is asked repeatedly</td>
<td>participate when he/she is asked repeatedly</td>
<td>engaging with friends easily when he/she is asked</td>
<td>play with friends on his/her own</td>
<td>invite friends to play with him/her</td>
</tr>
<tr>
<td><strong>Importance = 3,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Difficulty = 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sharing</strong></td>
<td>ignore/refuse to share snacks</td>
<td>need to ask more than once to share snacks (or) need to remind him/her to ask the owner before grabbing other people’s snacks.</td>
<td>share food when he/she is asked (or) exchange snack</td>
<td>share food on his/her own (or) ask other people properly for food</td>
<td>share food and exchange food in proper manner</td>
</tr>
<tr>
<td><strong>Importance = 3,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Difficulty = 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Waiting</strong></td>
<td>do not wait at all</td>
<td>need to remind frequently to wait</td>
<td>need to remind once for waiting</td>
<td>wait on his/her own but not with proper manner (noisy while waiting</td>
<td>wait in proper manner</td>
</tr>
<tr>
<td><strong>Importance = 3,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Difficulty = 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Although baseline scores should be considered as -2 (Kiresuk et al. 1994; Ruble et al. 2012), baseline scores were considered as -1 (less than expected) in this study for two reasons. Firstly, higher score as baseline score was set to know whether or not the intervention made the situations worse. Secondly, only very few students scored -2 based on the observation data and consultation with teachers. The common cause of those scores was mood (angry, sulking and so on) of students. The normal overall GAS for expected outcome should be 50 and that the score should be used to determine whether the participant has acquired the skill or not. To merge all scores from all sessions, scores were being averaged and it did affect some variations in the final GAS scores. To compensate for the score variation, the mean score (45) between normal and baseline value was used for judging.

4.4 Summary
This chapter has described the details of the development of prototype and materials, for example, the development of generalised animated social stories based on observation data from social visits. In addition, this chapter has also described how observation scales were set for each of the animated social stories according to Goal Attainment Scaling (GAS) (see section 3.3).

The next chapter will present in order how the actual research was conducted. It first describes how adjustments were made to planned procedures to fit actual situations. It is followed by how the participants were recruited and how the pre-assessment was conducted. Intervention with generalised animated social stories, differentiation and intervention with differentiated animated social stories are described consequently. Then analysis of data collected from the generalised and differentiated animated social stories interventions are presented and the chapter ends with the discussion of data analysis.
Chapter 5: Evaluation

This chapter evaluates the research carried out for this study. This chapter starts with the recruitment and profiling of the participants and how pre-assessment was conducted. Then the results of the first intervention with animated social stories are presented in tables. Next, the process of differentiating animated social stories which did not work well is described. This is followed by the presentation of results of the intervention with differentiated animated social stories. All results from both interventions are compared and are analysed. This chapter concludes with the discussion of the data analysis.

5.1 Participants of the Study

As stated in section 3.2, the selected research sites were PERKATA Special School, and a care centre in Kuching, East Malaysia. Upon getting both schools’ approvals, a tentative list of students who had been diagnosed with ASD were requested from both school principals together with their suggestions. A total of 26 students who had been diagnosed with ASD in these two research sites were available to participate in this research. Research information statement and consent form were then distributed to the students listed through teachers.

Table 12 summarises age, gender and observation notes of participants who gave consent to participate in this research. Pseudonyms such as Participant 01, Participant 02 etc., are used here to keep the participants anonymous.

As mentioned earlier, students were first shown educational video to let them get familiar with the tablet PC. Based on the observation data, the following criteria were set to filter the participants.

1. He/she must be a student diagnosed with Autism Spectrum Disorder.
2. He/she must be able to sit and watch video for at least two to five minutes. (It was found that some students were very restless. They were mostly playing/walking around the class during educational video sessions).

3. He/she must be able to respond to teachers as this was essential for assessment sessions.

Table 12 List of students with ASD who agreed to participate in the research

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Age</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Female</td>
<td>12</td>
<td>Speech problem, No sharing</td>
</tr>
<tr>
<td>02</td>
<td>Male</td>
<td>14</td>
<td>Slow response, Helpful, Interests (Gardening)</td>
</tr>
<tr>
<td>03</td>
<td>Male</td>
<td>12</td>
<td>Playful, Interests (Colouring)</td>
</tr>
<tr>
<td>04</td>
<td>Female</td>
<td>12</td>
<td>Attention problem, Repetitive behaviours, Interests (Writing)</td>
</tr>
<tr>
<td>05</td>
<td>Male</td>
<td>15</td>
<td>Speech problem, No sharing, Hit other children when angry, Interests (Playing with rubber bands)</td>
</tr>
<tr>
<td>06</td>
<td>Male</td>
<td>15</td>
<td>Attention problem, Interests (Gadget, Video)</td>
</tr>
<tr>
<td>07</td>
<td>Female</td>
<td>16</td>
<td>Echoing if she did not understand well, Interests (Cooking)</td>
</tr>
<tr>
<td>08</td>
<td>Male</td>
<td>10</td>
<td>Attention problem, Interests (Robots, Technology)</td>
</tr>
<tr>
<td>09</td>
<td>Male</td>
<td>08</td>
<td>Quick response, Playful, Interests (Drawing, Robot, Colouring)</td>
</tr>
<tr>
<td>10</td>
<td>Female</td>
<td>11</td>
<td>Slow response, Attention problem, Active, Interests (Computer)</td>
</tr>
<tr>
<td>11</td>
<td>Male</td>
<td>06</td>
<td>Quick response, Emotions, Active, Interests (Drawing, Computer)</td>
</tr>
<tr>
<td>12</td>
<td>Male</td>
<td>05</td>
<td>Attention problem, Interests (Drawing, Video)</td>
</tr>
<tr>
<td>13</td>
<td>Male</td>
<td>07</td>
<td>Short attention span, Interests (Drawing, Gadget, Technology)</td>
</tr>
<tr>
<td>14</td>
<td>Male</td>
<td>05</td>
<td>No sharing, No greeting, Interests (Colouring)</td>
</tr>
<tr>
<td>15</td>
<td>Male</td>
<td>06</td>
<td>Attention problem, Easily Moody, Interests (Video)</td>
</tr>
<tr>
<td>16</td>
<td>Male</td>
<td>05</td>
<td>Speech problem, Attention problem, A little restless, Interests (Colouring)</td>
</tr>
<tr>
<td>17</td>
<td>Female</td>
<td>06</td>
<td>Short attention span, No sharing, Interests (Video, Colouring)</td>
</tr>
<tr>
<td>18</td>
<td>Male</td>
<td>05</td>
<td>No Greeting, Interests (Gadget)</td>
</tr>
<tr>
<td>19</td>
<td>Male</td>
<td>05</td>
<td>Limited Speech, Attention problem, No sharing, Interests (Gadget, Video, Colouring)</td>
</tr>
<tr>
<td>20</td>
<td>Male</td>
<td>06</td>
<td>Speech problem, Attention problem, Easily moody, Interests (Colouring)</td>
</tr>
<tr>
<td>21</td>
<td>Male</td>
<td>07</td>
<td>Speech problem, Attention problem, Easily moody</td>
</tr>
<tr>
<td>22</td>
<td>Male</td>
<td>05</td>
<td>Slow response, Attention problem, Interests (Gadget, Drawing)</td>
</tr>
<tr>
<td>23</td>
<td>Male</td>
<td>05</td>
<td>Slow response, Attention problem, Easy to forget, Interests (Gadget, Drawing)</td>
</tr>
<tr>
<td>24</td>
<td>Male</td>
<td>14</td>
<td>Speech problem, Sensory problem, Attention problem, Restless</td>
</tr>
<tr>
<td>25</td>
<td>Male</td>
<td>10</td>
<td>Speech problem, Attention problem, Restless</td>
</tr>
<tr>
<td>26</td>
<td>Male</td>
<td>11</td>
<td>Speech problem, Attention problem, Restless</td>
</tr>
</tbody>
</table>
Based on the observation and consultation with the teachers, Participant 24, Participant 25 and Participant 26 were excluded from the study for the following reasons:

1. Participant 24, Participant 25 and Participant 26 were found to be restless, running around the class most of the time without watching most educational videos which other classmates were watching. This fidgety made it difficult for them to watch and pay attention to animated social stories on tablet.
2. In addition, Participant 24 had sensory issue. He felt no pain and this could pose some potential risks on the participant himself.
3. Participant 25 was transferred to another school during the filtering process.
4. Based on the observation and his teacher’s input, Participant 26 did not pay any attention to his teacher most of the time and did not seem to understand whatever was talked to him.

An unexpected problem regarding the participants also arose. The intervention for generalised animated social stories was conducted nearly at the end of the school term. When a new term started a month later, 8 participants had transferred to other schools.

This led to the number of participants reduced to 15. This can be considered a small sample size. Having a small sample size in this case is inevitable mainly because there were only a few children diagnosed with ASD in Kuching. According to The Malaysian Times, there are about 47,000 people who are officially diagnosed with ASD all over Malaysia (The Malaysian Times 2014) and they are spread out in different states and districts in Malaysia. In practice, firstly, it is not easy to reach out to every child with ASD in Kuching where the current research was conducted. Secondly, some parents did not give consent for their children to participate in the research because they felt it was not a good idea to allow their children to get involved in research. They were afraid
that their children might get hurt during research (See also Alina Rodriguez et al. 2006).

There were studies which produced good results despite the small sample size (Whipple 2004, Reaven et al. 2012). This research design employed a mixed mode combining qualitative and quantitative modes (see section 3.1). The behaviour frequencies seemed quantitative but observation and evaluation on emotions and behaviours was definitely qualitative. The limitation on the sample size became advantageous because observation would be more accurate with a smaller group of participants. According to Sauro (2015), effectiveness of intervention can be seen through 30% of the sample size. To have better results, failure rate for generalised animated social stories were set at 50%.

5.2 Conducting Pre-assessment
This was the first step of the research in which parents of participants were requested to fill in the social skill survey (see Appendix G Pre-assessment social skill survey form) to find out their primary languages and social skills situation of participants from the parents’ perspective. Data collected from the survey were used to tentatively assign common animated social stories to participants individually. To ensure appropriate social stories were assigned to individual students, this tentative assignment was checked against observation and confirmed with respective teachers. Then finalised assignment was used to assign social stories in SSA.

Participant 01 was assigned four common animated social stories which were “Asking for Help”, “Playing and Singing with Friends”, “Sharing” and “Waiting” as the survey data showed she had no problem with greeting people, controlling temper and paying attention but had some problems with taking part in the activities and waiting. According to the observation, she had difficulty in asking for help and sharing snacks with friends. She did not ask for any help most of the time when she needed help. She
did not share her snack with friends even if her teachers told her to share. She seemed to understand Chinese like her primary languages, Malay and English as identified from the survey data.

Participant 02 was assigned four common animated social stories which are “Asking for Help”, “Calming Down”, “Greeting Friends” and “Waiting”. His survey data showed that he had problems with controlling temper and greeting people. According to observation, he asked for help every time he needed. But the way he asked for help was rushing to his teacher. His survey data showed that he could wait but he did not wait properly. He usually rushed to his teacher almost every time he finished his tasks. One noticeable fact from observation was that he understood better when he was given instructions in English.

Participant 03 was assigned four common animated social stories which were “Asking for Help”, “Calming Down”, “Paying Attention” and “Waiting”. His survey data showed that his level of controlling temper, paying attention and waiting was lower than average. He rushed to his teacher for help in the same way as Participant 02.

Participant 04 was assigned four common animated social stories which were “Asking for Help”, “Calming Down”, “Greeting Friends” and “Paying Attention”. Based on her survey data, she had difficulties in controlling temper, greeting friends and paying attention. The observation showed that she did not ask for any help almost every time when she needed.

Four common animated social stories which were “Asking for Help”, “Calming Down”, “Greeting Friends”, and “Playing and Singing with Friends”, were assigned to Participant 05. According to survey data, he had problems with greeting people and joining activities. Observation data suggested that he had never asked for any help. When his teacher took rubber bands (his favourite toy) away from him, he became angry. He could not control temper and started to hit any classmate nearby.
Four common animated social stories i.e. “Asking for Help”, “Greeting Friends”, “Sharing” and “Waiting”, were assigned to Participant 06. The survey data showed that he had problems with greeting people and waiting. He did not ask for help though he could not finish his tasks. He did not share unless he was asked by his teacher.

Participant 07 was assigned four common animated social stories which were “Asking for Help”, “Greeting Friends”, “Playing and Singing with Friends” and “Sharing”. The survey data showed she had problems with greeting people and joining activities. She did not ask for help. If she could not do something by herself, she would be pacing the room until her teacher attended to her. She did not share her snack unless her teacher asked her to do so. Although all three languages, Malay, English and Chinese, were given the same scores in survey, she understood Chinese instructions better than the other two. When the researcher tried to confirm with her teacher, it was found that Chinese was mainly used at her home.

Participant 08 was assigned three common animated social stories which were “Asking for Help”, “Paying Attention” and “Waiting”. Based on the survey data, his social skills were given a score of 3 and above. From the observation, he was good in general. He could do almost all of his jobs. But he did not seek any help although he needed one. He did not pay attention to his teacher most of the time. Like Participant 2, he could not wait and rushed to his teacher after he had done his tasks.

Three common animated social stories which were “Asking for Help”, “Calming Down” and “Greeting Friends” were assigned to Participant 09. His survey data showed he had problems with controlling temper and greeting people. According to observation, he talked a lot but he barely asked his teacher for help. He used English most of the time though his survey data showed his primary language was Chinese.

Participant 10 was assigned three common animated social stories which were “Calming Down”, “Paying Attention” and “Waiting”. Based on her survey data, her skills
of controlling temper, paying attention and waiting were lower than average. According to observation, her attention span was too short to follow long instructions.

Participant 11 was assigned three common animated social stories which were “Calming Down”, “Paying Attention” and “Waiting”. The survey data revealed that he had problems with waiting. According to observation, he was easy to get emotional. Once he got emotional, it was hard to calm him down. Sometimes his attention was distracted while his teacher was giving instructions.

Participant 12 was assigned four common animated social stories which were “Calming Down”, “Greeting Friends”, “Paying Attention” and “Sharing”. According to his survey data, he did not greet friends and could not pay attention to his teacher. Based on observation, it was hard to calm him down once he became moody. He did not share snacks with friends even his teacher told him to do so.

Participant 13 was assigned two common animated social stories which were “Asking for Help” and “Paying Attention”. His social skills were average and above average based on the survey data. According to observation, he asked his teacher to help him. Like other participants, he rushed to his teacher and asked for help. Superficially, he seemed to pay attention because he was good in general. When instructions were given slightly differently, he missed those different instructions. It appeared that he did not pay attention fully.

Participant 14 was assigned three common animated social stories which were “Asking for Help”, “Greeting Friends” and “Sharing”. His survey data showed that he did not greet his friends and teacher. It was also observed that he did not ask for help and he did not share his snacks with friends.

Participant 15 was assigned three common animated social stories which were “Asking for Help”, “Calming Down” and “Paying Attention”. According to his survey data, his skills of controlling temper and paying attention were lower than average. During
observation, he did not seek any help when needed. He became moody instead of asking for help when he could not do something.

Four common animated social stories which were “Asking for Help”, “Paying Attention”, “Sharing” and “Waiting” were assigned to Participant 16. Based on his survey data, he could not pay attention and wait properly. According to observation, he had problems with asking for help due to his limited speech. He also did not share his snacks with friends.

Participant 17 was assigned four common animated social stories which were “Asking for Help”, “Paying Attention”, “Sharing” and “Waiting”. Her survey data showed she had problems with paying attention and waiting. The observation manifested that she did not ask for any help when she needed. She also refused to share her snacks every time she was asked to do so.

Participant 18 was assigned three common animated social stories which were “Asking for Help”, “Greeting Friends” and “Sharing”. Based on his survey data, he could not greet properly. According to observation, he did not seem to know how to ask for help. He also refused to share his snacks every time he was asked to do so.

Participant 19 was assigned four common animated social stories which were “Asking for Help”, “Greeting Friends”, “Paying Attention” and “Sharing”. According to the survey, he could not greet properly and could not pay attention. In addition, according to observation, he did not ask for help but was pacing up and down until his teacher attended to him. He also refused to share his snacks but he shared when he was asked repeatedly.

Three common animated social stories (“Asking for Help”, “Calming Down” and “Sharing”) were assigned to Participant 20. His survey data showed that he had problems with controlling temper. During observation, he did not seek help when he
needed. He did not share his snacks with friends. He simply ignored when he was asked to do so.

Participant 21 was assigned three common animated social stories which were “Asking for Help”, “Calming Down” and “Sharing”. According to the survey, he had little control over temper. He also did not ask for help most of the time when he needed. Like Participant 21, he ignored when he was asked to share his snacks.

Participant 22 was assigned three common animated social stories which were “Calming Down”, “Paying Attention” and “Waiting”. Both observation and survey data showed that he had problems with controlling temper, paying attention and waiting.

Three common animated social stories which were “Calming Down”, “Paying Attention” and “Waiting” were assigned to Participant 23. According to his survey data, his skills of controlling temper, paying attention and waiting were lower than average. No extra data was found from observation.

Based on data collected from the survey and observation validated through consultation with teachers, suitable generalised social stories created to train social skills that each participant was deficient in were assigned to individual participants of this research study.
The assignments of participants are summarised in Table 13 as follows.

Table 13 Animated social stories assigned to individual participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Fluency of Language (In order)</th>
<th>Asking for Help</th>
<th>Calming Down</th>
<th>Greeting Friends</th>
<th>Paying Attention</th>
<th>Playing and Singing with Friends</th>
<th>Sharing</th>
<th>Waiting</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Malay, English, Chinese</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>02</td>
<td>Malay, English</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>03</td>
<td>Chinese, Malay, English</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>04</td>
<td>English, Malay, Chinese</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>05</td>
<td>Chinese, English, Malay</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>06</td>
<td>Chinese, English, Malay</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>07</td>
<td>Malay, English, Chinese</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>08</td>
<td>English, Malay</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>09</td>
<td>Chinese, English, Malay</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>10</td>
<td>Chinese, English, Malay</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>11</td>
<td>English, Malay</td>
<td>✓</td>
<td></td>
<td></td>
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</tr>
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<td>12</td>
<td>Chinese, English</td>
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<td>14</td>
<td>Chinese, English</td>
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<td>15</td>
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<td>17</td>
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<td>18</td>
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<tr>
<td>19</td>
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<td>✓</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>21</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>22</td>
<td>English, Chinese</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>23</td>
<td>Chinese, English</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
5.3 Investigation of the Effectiveness of Common Animated Social Stories

After assigning suitable animated social stories to individual participants, the intervention using these common animated social stories started. The intervention was conducted as discussed in section 3.5.3.2. The original plan was to conduct 10 sessions for each participant. But not every participant had 10 sessions in this intervention due to poor attendance. Some participants received less than 5 sessions. After analysing the number of sessions, it was decided to keep 6 sessions which was the number of sessions that most participants received for data analysis. Data of participants who did not have 6 sessions were discarded to avoid data imbalance.

After the generalised social story intervention, these participants’ behavioural responses were observed by the researcher as planned. Observation scores were given according to the GAS as discussed in section 3.3 and section 4.3 for each story. The effectiveness of the first intervention was measured against the participants’ behavioural responses to targeted social situations as revealed in the analysis of observation data.

The following subsections presents the effectiveness of each common animated social story as measured through participants’ behavioural responses to the respective situations. Each sub-section will start with a table which summarises the scores obtained by individual participants who were assigned the same story. This is followed by the description of scoring criteria and related expected behavioural responses and that of the participants’ level of achievement.

5.3.1 Behavioural Responses to the Story “Asking for Help”

The social story “Asking for Help” was assigned to 13 participants in the first intervention. As discussed in section 4.3, scores were given according to the behavioural responses of these participants: -2 for getting into bad moods when participants could not do the tasks they were given; -1 for doing nothing and dashing to
teachers, 0 for asking for help, 1 for asking for help by calling teacher and 2 for asking for help politely. Table 14 provides an overview of the scores each participant obtained given their behavioural responses.

### Table 14 Responses of assigned participants for "Asking for Help"

<table>
<thead>
<tr>
<th>Session 01</th>
<th>Session 02</th>
<th>Session 03</th>
<th>Session 04</th>
<th>Session 05</th>
<th>Session 06</th>
<th>Avg GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2 -1 0 1 2</td>
<td>-2 -1 0 1 2</td>
<td>-2 -1 0 1 2</td>
<td>-2 -1 0 1 2</td>
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<td>2</td>
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</tr>
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</tr>
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<td>13</td>
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<td>40</td>
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</tr>
</tbody>
</table>

As can be seen in the table, the lowest average GAS score for all sessions was 41.67 obtained by Participant 16 and the highest was 53.33 by Participant 02. Four participants who were Participant 04, Participant 15, Participant 16 and Participant 18 achieved average GAS score lower than 45 for this animated social story. It can be seen that every participant did improve their skill associated with this story according to their sessional GAS scores. As Participant 01, Participant 05 and Participant 16 had speech problem, their scores were given according to non-verbal rules (see chapter 4.3). The detailed responses of participants as observed are described as follows.
1. Participant 01 did not ask for any help for 2 sessions but she started giving noises to get help in the third session. She did put up her hand and made proper noise in the fourth session.

2. Participant 05 sometimes did not ask for help when he needed though he knew how to ask. He was quite moody especially when he held his favourite rubber bands.

3. Participant 16 had limited speech and was quite active. His attention span was too short. When he could not do his tasks, he started to cry. That was the reason for having the score -2 twice. Though he got many negative scores in every session, he asked for help properly in sessions 5 and 6. He was the one who got the lowest GAS score for this story.

4. Participant 02, Participant 03, Participant 08 and Participant 13 usually dashed to their teachers if they needed help. Participant 02, Participant 08 and Participant 13 did not dash anymore after three sessions. Participant 03 dashed once again in the fifth session.

5. Though Participant 02 performed correctly in most sessions, his facial expressions were not good enough to express his will of asking for help. That was why he did not get the score 2.

6. Participant 13 did express properly in sessions 5 and 6.

7. Participant 04 had little speech. Mostly she just sat in her place though she needed help in the first and second sessions. After 2 sessions, she started to ask her teacher for help related to her favourite task (writing). She was one of four participants who achieved average GAS score below 45.

8. Participant 09 did not ask for help when he needed in the first session. He did ask his teacher to help him in drawing robots (his favourite task) but not in proper way. He just shouted the word “teacher” and he did not raise his hand. In the following sessions, although he asked for help every time he needed, the
behaviour remained the same. Because of that, he did not get any score higher than 0.

9. Participant 14 was a fast learner. He did well after 2 sessions. He was the same as Participant 02. He got the score 1 as the highest due to lack of proper facial expressions.

10. Participant 15 did not ask for help. Instead, he became moody when he could not do something. He was also one of four participants who had average GAS score below 45. His performance was getting better though sometimes he did not ask for help in the later sessions.

11. Participant 17 also became moody when she could not do the tasks given to her. But she calmed down immediately once she was asked not to do what she could not do. She asked for help in the later sessions. Like Participant 09, she just called her teacher without raising her hand.

12. Participant 18 did not know he should ask his teacher for help before. He was also a fast learner and he called his teacher to help him in the second session. He did properly ask his teacher to help him twice in last 2 sessions.

13. Participant 04, Participant 15, Participant 16, Participant 17 and Participant 18 were less interested in this animated social stories compared to other participants.

To sum up, 9 out of 13 participants (69.2%) were observed to demonstrate that they had acquired how to ask for help. This animated social stories did help more than half of the participants in acquiring the skill of asking for help.

5.3.2 Behavioural Responses to the Story “Calming Down”

The generalised social story “Calming Down” was assigned to 10 participants. The scores obtained by these 10 participants due to their behavioural responses are tabulated in Table 15. Here, -2 was given for going into bad moods especially getting angry and crying if something went wrong, -1 when the participant could not calm down
even when teachers tried to calm him/her down, 0 if partial control was demonstrated, 1 for proper control on temper, and 2 when he/she explained why he/she went into bad moods after calming himself or herself down properly (see also section 4.3).

As can be seen in Table 15, Participant 03 scored the highest and Participant 15 scored the lowest with 47.78 and 36.47 respectively. Nine out of ten participants had average GAS score below 45. The only participant whose average GAS score was higher than 45 was Participant 03. The following is what was observed:

1. Participants 03 was not able to calm down when he could not do things he wanted especially with the snacks. He was able to count 1 to 10 later. He controlled his temper properly only twice.

2. Participant 04 used an eraser repeatedly until the paper was thorn if she wrote wrongly. She could barely count 1 to 10 and her improvement for this story was quite slow.

<table>
<thead>
<tr>
<th></th>
<th>Session 01</th>
<th>Session 02</th>
<th>Session 03</th>
<th>Session 04</th>
<th>Session 05</th>
<th>Session 06</th>
<th>Avg GAS</th>
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<td></td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Table 15 Responses of assigned participants for "Calming Down"
3. Participant 05 became violent when his rubber bands were taken away from him. Although he could not count due to his speech problem as mentioned before (see section 5.1), he could take a deep breath. This animated social story seemed to be too hard for him to understand. He hardly performed in the last 2 sessions.

4. Participant 09, Participant 10 and Participant 12 were all the same. They were able to calm down when their teachers attended to them. Though they were able to count 1 to 10, none of them seemed to understand the story or know they needed to take a deep breath.

5. Participant 11 improved slightly though his scores did not change much. At first, it was so easy for him to cry and his teacher took more than 10 minutes to calm him down. Later, it did not take much time to calm him down. He seemed to understand the story but he counted 1 to 10 only twice for this intervention.

6. The improvement of Participant 15 was quite small. He got the lowest average GAS score for this story.

7. Participant 22 and Participant 23 seemed they understood the story partially. They counted 1 to 10 during the time when they could not calm down.

Most participants assigned to this story did not understand both the concept of the story and the gesture for taking a deep breath. The researcher had to demonstrate the action for them to understand better. Some participants especially Participant 04, Participant 12 and Participant 15 lost interest while watching this animation. Feedback from teachers pointed to the fact that sentences used in this story were too long for participants to understand.

5.3.3 Behavioural Responses to the Story “Greeting Friends”

In the first intervention, 7 participants were assigned to the generalised social story “Greeting Friends”. The purpose of this story was to help participants in learning the social skill to greet friends which is a very essential skill in socialising. Table 16
illuminates scores achieved by these 7 participants according to their demonstrated behavioral responses to the targeted social situation.

Table 16 Responses of assigned participants for "Greeting Friends"

<table>
<thead>
<tr>
<th></th>
<th>Session 01</th>
<th>Session 02</th>
<th>Session 03</th>
<th>Session 04</th>
<th>Session 05</th>
<th>Session 06</th>
<th>Avg GAS</th>
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</thead>
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<td>-2 -1 0 1 2</td>
<td>-2 -1 0 1 2</td>
<td>-2 -1 0 1 2</td>
<td>-2 -1 0 1 2</td>
<td>-2 -1 0 1 2</td>
<td></td>
</tr>
<tr>
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<td>2 50 1 1 55</td>
<td>1 1 55</td>
<td>11 65</td>
<td>52.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
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<td>2 45 2 2 48</td>
<td>1 1 50</td>
<td>2 55</td>
<td>48.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>1 1 45 1 2</td>
<td>2 48 2 2 48</td>
<td>2 1 48</td>
<td>11 55</td>
<td>49.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3 2 44 1 3</td>
<td>2 50 2 2 50</td>
<td>2 1 53</td>
<td>2 50</td>
<td>49.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1 3 48 2 1</td>
<td>1 2 53 1 2 50</td>
<td>1 2 52</td>
<td>2 55</td>
<td>50.33</td>
<td></td>
<td></td>
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<tr>
<td>18</td>
<td>3 2 44 2 3</td>
<td>2 46 2 3 46</td>
<td>2 1 53</td>
<td>12 57</td>
<td>52.36</td>
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<td></td>
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</table>

The scoring rules (see section 4.3) set for this story include: -2 for refusing or ignoring to greet even if the participants were asked for several times; -1 for greeting after they were asked for several times; 0 for greeting their peers easily when they were asked; 1 for greeting their friends without being asked; and 2 for greeting friends using good nonverbal clues (smiling or waving hands).

According to Table 16, the highest mark 52.78 was achieved by Participant 02 and the lowest score 47.42 by Participant 18. There was no participant whose average GAS score was lower than 45 for this animated social story. The detailed observation is presented below.

1. Participant 2 did not greet his friends after the first session of intervention. He greeted his friends when he was asked for 4 times. Although he followed the actions from the animated social stories while watching it, he had to be asked
twice to greet his friends in the second session. Starting from session 3, he was getting better. In the last session, he greeted his friends with smiles.

2. Except for Participant 04 and Participant 18, the rest of the participants followed the actions from “Greeting Friends” during intervention. Some of them still scored -1 till the fourth session because they had to be asked for a few times to greet certain friends.

Observation data and the score that participants achieved indicate that all participants were able to pick up the skills from this animated social story except for Participant 04 and Participant 18 who showed less interest compared with other participants. Greeting friends is a common behaviour which participants are usually asked by teachers every day. The familiar and practical task might well encourage the participants in picking up the skill more quickly than other social skills.

5.3.4 Behavioural Responses to the Story “Paying Attention”

There were 12 participants who were assigned the common animated social story “Paying Attention” as the first intervention. Scores were given according to their response as follows (see also section 4.3):

1. -2 for pacing or ignoring while teachers were talking or giving them instructions
2. -1 for needing to be reminded frequently to focus.
3. 0 for needing to be reminded to pay attention only once
4. 1 for paying attention without being reminded
5. 2 for paying attention and responding properly without being reminded.

Table 17 presents the scores obtained by twelve individual participants who were assigned to the story “Paying Attention” according to their behavioural responses to the targeted situation.

Table 17 Responses of assigned participants for “Paying Attention”
According to the table, the highest average GAS score was 47.67 obtained by Participant 13. The lowest score 41.11 was obtained by Participant 10 and Participant 22. The achievement level of the participants was very low for this story. Eight out of twelve participants’ average GAS scores were lower than 45. Observation data is provided as follows.

1. All the participants especially Participant 04, Participant 10, Participant 12, Participant 15, Participant 16 and Participant 17 needed to be reminded frequently when their teachers were giving instructions.

2. Only Participant 13 did pay attention and properly responded to his teacher twice in the last session.

3. Most of the participants did lose their attentions to this animated social story while watching. Their interest declined from time to time. They seemed quite confused with both the gestures of characters and story line. Even Participant
13 with the highest score partially understood this animated social story. He was also confused with gestures of characters from animation.

According to feedback from teachers, the story should focus on paying attention to teacher only instead of teacher and friend. One of the teachers advised that it would be better if the scene of praising from the teacher character to the student character is included.

5.3.5 Behavioural Responses to the Story “Playing and Singing with Friends”

There were two participants who were assigned the common animated social story “Playing and Singing with Friends” in the first intervention. The scoring rules for this story were quite similar to “Greeting Friends” (see section 4.3): -2 for refusing to play with friends or ignoring even if he or she was asked repeatedly; -1 for playing together with friends when asked repeatedly; 0 for playing with friends when asked once only; 1 for joining on his or her own accord; and 2 for inviting other friends to play together.

Table 18 below provides the scores achieved by these 2 participants according to their demonstrated behavioural responses.

<table>
<thead>
<tr>
<th></th>
<th>Session 01</th>
<th>Session 02</th>
<th>Session 03</th>
<th>Session 04</th>
<th>Session 05</th>
<th>Session 06</th>
<th>Avg GAS</th>
</tr>
</thead>
<tbody>
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<td>-2 -1 0 1 2</td>
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<td>2 2 55 1 1</td>
<td>2 2 55 1 1</td>
<td>2 1 1 58 1 1</td>
<td>51.25</td>
</tr>
<tr>
<td>05</td>
<td>2 3 46 2 3</td>
<td>2 3 46 2 3</td>
<td>1 3 50 1 1</td>
<td>2 2 55 1 1</td>
<td>1 1 55 1 1</td>
<td>1 1 55 1 1</td>
<td>51.17</td>
</tr>
</tbody>
</table>

The table clearly shows that both participants scored almost the same. The following is the progress of their behaviour as observed by the researcher:
1. Both participants refused a few times to play together with their friends in the early sessions.

2. After 3 intervention sessions, they needed to be asked only once to join their friends.

3. The score 1 had been the most expected score from them because this animated social story did not include any scene about inviting friends to join. It was really unexpected when Participant 01 grabbed the hand of her friend who sat beside her, and played together. That was how she scored 2 once in the last session.

The observation shows that both participants clearly understood this animated social story and learnt the skill from this animated story to play together with friends.

Like the story “Greeting Friends”, the behaviour of playing and singing with friends is normally asked by teachers to participants in their daily activities. This might well lead to faster and more successful acquisition of the skill aimed by that story than the skills targeted by other stories.

5.3.6 Behavioural Responses to the Story “Sharing”

There were altogether 7 participants who were assigned the common animated social story “Sharing”. As in the previous stories, behavioural responses of these participants were noted down and scores were given using the criteria given below (see also section 4.3):

1. -2 for ignoring or refusing to share snacks

2. -1 for sharing snacks when asked several times or for needing to be reminded when he or she grabbed his or her friends’ snacks without consent

3. 0 for willingness to exchange food or share food easily when asked

4. 1 for sharing snacks on his or her own accord

5. 2 for sharing and exchanging politely.
Table 19 below demonstrates scores obtained by 7 participants who were assigned the story “Sharing” depending on their behavioural responses to the given situation.

Table 19 Responses of assigned participants for "Sharing"

<table>
<thead>
<tr>
<th></th>
<th>Session 01</th>
<th>Session 02</th>
<th>Session 03</th>
<th>Session 04</th>
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</table>

The highest score for this story was 50.83 achieved by Participant 03 and the lowest was 42.92 scored by Participant 01. Two participants who were Participant 01 and Participant 17 scored less than 45. Details of the participants' responses are provided below.

1. Participant 01 and Participant 17 shared their snacks only if they were asked repeatedly. Participant 01 shared her snacks on her own only once in the last session and Participant 17 shared on her own twice in the last 2 sessions. It was easier to exchange snacks with them. All of their 0 scores came from exchanging.

2. Apart from them, the rest shared on their own will in the last few sessions. But they all started with exchanging snacks before sharing easily.

3. All participants except Participant 01 and Participant 17 were able to acquire sharing skill through this animated social story. According to feedback from
teachers of Participant 01 and Participant 17, they understood the story but they simply did not wish to share.

The table and observation data show clearly that 5 out of 7 participants successfully acquired the skill of sharing and exchanging during snack time substantiated through their demonstrated improved behavioural responses.

### 5.3.7 Behavioural Responses to the story “Waiting”

9 participants were assigned to the generalised social story “Waiting”. The scoring rules (see section 4.3) used to determine the effectiveness of the story through observed behavioural responses to the target social situation include:

1. -2 for not waiting until his or her teacher was free
2. -1 for having to be reminded frequently to wait
3. 0 for having to be reminded only once to wait
4. 1 for waiting on his or her own but in improper way (e.g. making noises or running around the class)
5. 2 for waiting and spending time properly on something useful.

Table 20 below shows the scores of 9 participants assigned to the story “Waiting”. 
Table 20 Responses of assigned participants for "Waiting"

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<td>1 1 45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>3 40 3 40</td>
<td>3 40</td>
<td>3 40</td>
<td>2 40</td>
<td>2 1 43</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The highest and lowest scores of the story, as can be seen in the table, were 45.83 and 41.11 obtained by Participant 08 and Participant 23 respectively. Seven out of nine participants scored lower than 45. The following is what was observed:

1. Most participants especially Participant 01, Participant 16 and Participant 17 needed to be reminded frequently to wait because they ran to their busy teachers straight away most of the time they wanted to show their homework or to ask for permission to go to the washroom.

2. Some participants, Participant 02, Participant 08 and Participant 11 waited once they were asked in the last few sessions though sometimes they needed to be reminded repeatedly.

3. Participant 16 and Participant 17 did not show interest in this animation as in other animated social stories they were assigned to.

4. Except for Participant 02 and Participant 08, other participants did not understand the gestures of animation characters. The instructions were somewhat complicated.
for them. Even Participant 02 and Participant 08 partially understood this animated social story.

5.3.8 Discussion

The social story intervention implemented by this research study made use of the tablet PC as the medium through which social stories was delivered. This intervention proves that using a tablet motivated the participants well as even Participant 04, Participant 15, Participant 16, Participant 17 and Participant 18, who showed less interest in the animated social stories, did not reject any intervention session due to the tablet.

As for the use of animation, the first intervention suggests that the animation worked, but to a certain extent, for some participants especially Participant 15, Participant 16 and Participant 17 who showed less interest in these animated social stories. Participants (Participant 02 and Participant 08) who can read were willing to read and watch at the same time.

A point worthy of note is that some participants, Participant 15, Participant 16, Participant 17 and Participant 23 who were less interested in the animated social stories they were assigned were observed to be more attracted towards animal characters (animals acting like human, for example, Tom & Jerry) than human characters. During observation, they showed keen interest in educational videos and animations in which animal characters were featured.

It was also observed that participants like Participant 02 and Participant 08, who can read, were reading subtitles/lyrics from educational videos. It seemed they were more interested to read than listen to audio from videos. In other words, they seemed to learn better by reading than by listening.

Those data mentioned above are the data generated from intervention using common animated social stories. Details of these data analysis are presented to explain how these common animated social stories were differentiated in the next section.
5.4 Differentiation of Animated Social Stories

After presenting data collected from intervention of common animated social stories, collected data were analysed and the analysis of data is presented below.

According to the tables provided in the previous section (Table 17 to 23), the failure rates of common animated social stories were calculated. As discussed in section 3.5.3.3, the failure rate of generalised social stories was set to 50% to get reliable data though the effectiveness could be seen through 30%. The failure rates were 30.77% for “Asking for Help”, 90.00% for “Calming Down”, 00.00% for “Greeting Friends”, 66.67% for “Paying Attention”, 00.00% for “Playing and Singing with Friends”, 28.57% for “Sharing” and 77.78% for “Waiting”. Out of seven stories, three stories, “Calming Down”, “Paying Attention” and “Waiting”, turned out not to work well.

Despite having higher failure rates, those three animated social stories were able to help some participants such as Participant 02, Participant 03, Participant 04, Participant 08 and Participant 12 in associated social skills acquisitions. According to sessional GAS scores, the behaviours of those participants were improved steadily. This might affect the average sessional GAS scores of those three animated social stories in evaluation. As stated in section 3.1, the risk was already expected and the measures were taken.

But other participants especially Participant 01, Participant 09, Participant 10, Participant 11, Participant 15, Participant 22 and Participant 23 did not improve much on social skills linked to those three animated social stories. These animated social stories were not able to attract the attention of those participants well as a decline in their interest in these stories was observed from time to time. Data came from observation (see section 5.3) and feedback from teacher also indicated that (1) gestures from those three animated social stories confused most of the participants and (2) instructions from “Paying Attention” and “Waiting” were unnecessarily long and somewhat complicated. In short, those three animated social stories were not good
enough to help the participants acquiring social skills related to those three animated social stories.

Both the failure rates and observation data suggested that those three animated social stories had to be differentiated to meet the needs of the participants based on teachers’ feedback and observation data. It was also decided that the other four stories would be neither differentiated nor included on the next intervention as the results of these stories clearly indicated that they worked well.

Firstly, scripts of those three stories had to be rewritten at the level all participants could easily understand and animations were to be differentiated according to feedback from teachers and observation data. Details of differentiation are presented below.

### 5.4.1 Calming Down (Differentiated Version)

This was the animated social story which had the highest failure rate. As discussed earlier, sentences of the script were too long for participants to understand according to teachers. Firstly, sentences in this story were revised to become shorter and to convey the intended meaning more clearly though they were not, in fact, too long.

Based on observation data, most participants did not understand some of the gestures especially “taking a deep breath”. Thus, secondly, the gesture for “confused” was removed not to let participants get confused with that of “taking a deep breath”. Some artists were consulted so that the gesture of “taking a deep breath” could be modified.

Due to software limitation, the modification, however, was not made to satisfaction.

As Participant 15, Participant 16, Participant 17 and Participant 23 were observed to prefer animal characters to human characters, thirdly, the main character was switched to the animal character for these participants. Fourthly, subtitles were added for participants who can read. Refer to Table 21 for the revised script and Figure 45 for the screenshots of the differentiated “Calming Down” social story.
Table 21 Script of “Calming Down (Differentiated Version)”

<table>
<thead>
<tr>
<th><strong>Calming Down (Differentiated Version)</strong></th>
<th><strong>Type of Sentence</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi! My name is Amy.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>When I feel angry, first I will take a deep breath.</td>
<td>Directive</td>
</tr>
<tr>
<td>I will count one to ten.</td>
<td>Directive</td>
</tr>
<tr>
<td>One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Ten</td>
<td>Demonstrating of counting one to ten</td>
</tr>
<tr>
<td>Then, I will talk to the teacher why I feel angry.</td>
<td>Directive</td>
</tr>
<tr>
<td>She can help me to solve the problem.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>This will help me feel better.</td>
<td>Perspective</td>
</tr>
</tbody>
</table>

Figure 45 Screenshots of “Calming Down (Differentiated Version)"

5.4.2 Paying Attention (Differentiated Version)

As with the story “Calming Down”, most participants did not get the story lines as well as gestures of the story “Paying Attention”. Advices from the teachers were sought and these include (1) to include a praising scene and (2) to use one specific character “teacher” in the demonstration scenes instead of two characters “teacher” and “friend”. Based on these, the script was rewritten, a scene of praising from teacher was added at the end and the character “friend” was removed. Despite software limitation, some gestures were revised carefully based on consultation with some artists. The main human character was replaced with the animal character for participants who preferred animal characters. Subtitles were added. Refer to Table 22 for the script of the
differentiated animated social story “Paying Attention” and Figure 46 for the screenshots of the story as the outcomes of differentiation.

Table 22 Script of “Paying Attention (Differentiated Version)”

<table>
<thead>
<tr>
<th>Paying Attention (Differentiated Version)</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi! My name is Amy.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>When the teacher talks to me, I will look at her face only.</td>
<td>Directive</td>
</tr>
<tr>
<td>I will try to pay attention to what she says.</td>
<td>Directive</td>
</tr>
<tr>
<td>Only then, the teacher will be very happy.</td>
<td>Perspective</td>
</tr>
<tr>
<td>Teacher: Oh Amy! You are such a good girl! I am so happy.</td>
<td>Demonstration of happiness in animation</td>
</tr>
</tbody>
</table>

Figure 46 Screenshots of “Paying Attention (Differentiated Version)”

5.4.3 Waiting (Differentiated Version)

Based on feedback from teachers and observation, this story was rewritten to minimal version. Gestures were used in both the explanation scenes and demonstration scenes for participants to have a better understanding of the story. The main character was substituted with the animal character for participants who loved to watch animal characters. Subtitles were added for participants who can read well. See Table 23 for the script of the differentiated animated social story “Waiting” and Figure 47 for its screenshots.
Table 23 Script of “Waiting (Differentiated Version)”

<table>
<thead>
<tr>
<th>Waiting (Differentiated Version)</th>
<th>Type of Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi! My name is Amy.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>I should wait if someone I want to talk is busy</td>
<td>Directive</td>
</tr>
<tr>
<td>I will wait until he or she is free.</td>
<td>Directive</td>
</tr>
<tr>
<td>I will try to keep quiet.</td>
<td>Directive</td>
</tr>
<tr>
<td>Teacher is busy now. I should wait until she is free. I should also keep quiet.</td>
<td>Demonstration of scene in animation</td>
</tr>
</tbody>
</table>

In addition to differentiation made to these stories as described above, as proposed in this study, an on-going assessment was added to each differentiated animated social story (see section 1.2 and section 3.5.3.3). Like Croker (1999), this study believes that integration of on-going assessment can help not only parents and teachers to track improvement or progress made by their children or students but also children to have a better understanding of what they have learned. Multiple choice questions (MCQ) were used as an on-going assessment in this research. The details of the development of MCQ are presented in the following sections.

5.4.4  MCQ for the story “Calming Down”

The main idea of this animated social story was to help participants to calm down by himself or herself. The trick was counting 1 to 10 or taking a deep breath or both. The
question for this story was “What will you do when you feel angry?” The choices were “counting 1 to 10”, “having fight”, “throwing book” and “running around”. Counting 1 to 10 was set as the correct answer over taking a deep breath to avoid misunderstanding of gestures. Though MCQ answers were animated pictures, it was still hard to present “taking a deep breath” in animated picture. Note that those animated MCQ answers would become static images in the printed copy of this thesis.

![MCQ for Calming Down](image)

**Figure 48 Sample of MCQ for Calming Down**

### 5.4.5 MCQ for the story “Paying Attention”

This animated social story was for participants who could not pay attention when teachers talked to them. This animated social story was quite straightforward. The question set for this story was “What will you do when the teacher talks to you?” Four choices given were “look at the teacher and pay attention to what she says”, “show no respect to teacher”, “do not look at teacher” and “walk away from teacher”. MCQ answers given in GIF were provided below. Note that those animated MCQ answers would become static images in the printed copy of this thesis.
5.4.6 MCQ for the story “Waiting”

The idea behind this animated social story was for participants to learn to wait patiently. The MCQ question set for this story was “What will you do when you would like to talk to your teacher and she is not free?” Four choices given were “wait for her quietly”, “raise my hand and call the teacher”, “just talk to the teacher” and “crying”. The correct answer was “waiting for her patiently”.

MCQ answers are provided in Figure 50. Bear in mind that those animated MCQ answers would become static images in the printed copy of this thesis.
After finishing differentiation of generalised animated social stories and development of MCQ as on-going assessment of each story, the intervention using differentiated animated social stories was conducted.

5.5 Investigation of the Effectiveness of Differentiated Animated Social Stories

Three animated social stories (“Calming Down”, “Paying Attention”, “Waiting”) which were not able to help the participants acquire associated social skills in the first intervention were differentiated based on observation data and teachers’ feedback to meet the needs of the participants and MCQ questions were added as on-going assessment (see section 5.4). Before conducting intervention using those three animated social stories, an unexpected problem with regard to participants arose. As mentioned in section 5.1, a total of 8 participants of this research transferred to other schools. They were Participant 08, Participant 13, Participant 14, Participant 15, Participant 17, Participant 18, Participant 20 and Participant 21. Participant 07 was excluded from this intervention because none of those three differentiated animated social stories were assigned to her. There were only 14 participants in total for this intervention.

The original plan was to conduct 10 sessions for both interventions. Due to poor attendances, only 6 sessions were conducted in average for the first intervention. Following the first intervention, 6 sessions of the second intervention were conducted with these participants to avoid data inconsistency. As in the first intervention, three differentiated animated social stories were presented to the participants on SSA using a tablet computer. After that, participants were asked to take on-going assessments (MCQ) related to the differentiated animated social stories to which they were assigned. This was followed by the observation as in the first intervention.

Two more rules were added for taking MCQ. If a participant can answer an MCQ of a differentiated animated social story correctly, 0 was given to the participant for that
differentiated animated social story based on the expectation or assumption that participants could answer it correctly if they understood the story. If he or she got it wrong, -1 was given. Details of participants’ behavioural responses for three differentiated animated social stories are presented in the following sub-sections.

**5.5.1 Behavioural Responses to the Differentiated version of “Calming Down”**

A total of 9 participants were assigned to the differentiated version of the social story “Calming Down”. Table 24 presents behavioural responses of these participants to the differentiated animated social story “Calming Down”.

Table 24 Responses of assigned participants for differentiated version of "Calming Down"

<table>
<thead>
<tr>
<th>Participant</th>
<th>Session 01</th>
<th>Session 02</th>
<th>Session 03</th>
<th>Session 04</th>
<th>Session 05</th>
<th>Session 06</th>
<th>Avg GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>-2 1 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>52.64</td>
</tr>
<tr>
<td>04</td>
<td>2 2 45 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>49.86</td>
</tr>
<tr>
<td>05</td>
<td>2 2 45 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>49.72</td>
</tr>
<tr>
<td>09</td>
<td>3 2 44 2 3</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>47.00</td>
</tr>
<tr>
<td>10</td>
<td>2 1 43 2 1</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>47.22</td>
</tr>
<tr>
<td>11</td>
<td>2 1 43 2 1</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>47.22</td>
</tr>
<tr>
<td>12</td>
<td>2 1 43 2 1</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>47.22</td>
</tr>
<tr>
<td>22</td>
<td>2 1 43 2 1</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>47.50</td>
</tr>
<tr>
<td>23</td>
<td>2 1 43 2 1</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>-1 0 1 2</td>
<td>46.94</td>
</tr>
</tbody>
</table>

The scoring rules were the same as those in the first intervention (see section 4.3): -2 and -1 was given for moody reactions and not calming down even with teachers’ attention; 0 for partial control; 1 for proper control on temper and 2 for explaining to his or her teacher why he/she got mad after calming himself or herself down. The highest average GAS score was 52.64 by Participant 03 and the lowest 46.94 by Participant.
23. None of the participants obtained average GAS score lower than 45. GAS score of each and every participant improved significantly one after another session. Details of their responses are as follows:

1. Participant 03 tried to calm down for a few times in the early session. But he only counted 1 to 10. He was given the score -1 in the first session because he chose a wrong answer for MCQ. He chose correctly in the later sessions.

2. Observation highlighted that Participant 04 loved to write. During the first intervention, she was observed to read subtitles. She did choose the wrong MCQ answer till the third session. She counted 1 to 10 when she tried to use the eraser repeatedly.

3. Participant 05 was getting better in controlling his temper from session to session when his rubber bands were taken away by his teacher. He chose the wrong answer only once in the first session.

4. Participant 09, Participant 10 and Participant 12 seemed to understand this differentiated animated social story. Though they could not calm themselves down properly, they were able to do partially.

5. Participant 11 did not cry easily and he was able to count 1 to 10 when he was about to cry. But he chose the wrong MCQ answer sometimes.

6. Participant 22 and Participant 23 counted 1 to 2 and learned how to take a deep breath. But they had to be reminded to calm down.

7. The focus of Participant 04 was getting better when she read subtitle. The attention of Participant 23 seemed to improve.

During the second intervention, the researcher had to demonstrate how to take a deep breath because some participants still did not understand the revised gesture “taking a deep breath” (See also section 5.5.1). All participants understood the story line well though some of them did not understand the revised gestures. Nevertheless, this differentiated animated social story was able to help participants acquiring one of social
skills “calm down”. MCQ also helped them recall what to do and apply what they had acquired easily when they felt angry.

5.5.2 Behavioural Responses to the Differentiated Version of the Story “Paying Attention”

In the second intervention, a differentiated version of the social story “Paying Attention” was assigned to 9 participants. Table 25 demonstrates behavioural responses of 9 participants to the modified version of “Pay Attention”.

Table 25 Responses of assigned participants for differentiated version of "Paying Attention"

<table>
<thead>
<tr>
<th>Participant</th>
<th>Session 01 G</th>
<th>Session 02 G</th>
<th>Session 03 G</th>
<th>Session 04 G</th>
<th>Session 05 G</th>
<th>Session 06 G</th>
<th>Avg. GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>50.00</td>
</tr>
<tr>
<td>04</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>49.44</td>
</tr>
<tr>
<td>10</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>48.06</td>
</tr>
<tr>
<td>11</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>47.78</td>
</tr>
<tr>
<td>12</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>47.48</td>
</tr>
<tr>
<td>16</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>45.83</td>
</tr>
<tr>
<td>19</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>45.83</td>
</tr>
<tr>
<td>22</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>47.78</td>
</tr>
<tr>
<td>23</td>
<td>-2, 1, 0, 2</td>
<td>-1, 0, 1, 2</td>
<td>-1, 0, 1, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>-2, 1, 0, 2</td>
<td>46.11</td>
</tr>
</tbody>
</table>

The same scoring criteria were used: -2 for pacing out or ignoring; -1 was for requiring to be reminded frequently to pay attention; 0 for having to be reminded only once to focus; 1 for not having to be reminded to pay attention; and 2 for both paying attention and responding properly. The highest average GAS score 50.00 was achieved by Participant 03. Both Participant 16 and Participant 19 scored the lowest average GAS score 45.83. As in the first differentiated story, no participant scored lower than 45.
According to sessional GAS scores of the participants, it can clearly be seen that all participants in this story gradually improved session by session.

The following is the progress of their behavioural responses to the assigned story and related social situation as observed by the researcher:

1. Participant 03 behaved better from session to session when the teacher was giving instructions.
2. Participant 04 did not lose her interest in this animated social story any more. Her focus was improved by reading subtitles from the animated social story.
3. Nearly half of participants especially Participant 12, Participant 16 and Participant 19 had to be reminded frequently while giving instructions until the fourth session.
4. Attention of both Participant 22 and Participant 23 to this animated social story and their behaviours were improved session by session.
5. All participants except Participant 16 and Participant 19 did very well in on-going assessment (MCQ). They still chose wrong answers till the fifth session.
6. Some participants such as Participant 03, Participant 11, Participant 22 and Participant 23 understood this animated social story but some such as Participant 04 and Participant 16 partially understood the story. Though Participant 19 was confused with the revised gesture, his behaviours while giving instruction got better.

To sum up, the scores as outcomes of the observation of participants’ behavioural responses highlight that all participants acquired the social skill to pay attention to teacher with the help of the differentiated animated social story “Paying Attention”.

5.5.3 Behavioural Responses to the Differentiated version of the Story “Waiting”

A total of 8 participants, Participant 01, Participant 02, Participant 06, Participant 10, Participant 11, Participant 16, Participant 22 and Participant 23 were assigned to the differentiated version of the social story “Waiting” in the second intervention. The
scoring rules were the same as the first intervention: -2 for not waiting at all; -1 for having to be reminded frequently; 0 for having to be reminded only once, 1 for waiting but in improper way; and 2 for waiting in proper way.

Table 26 illustrates behavioural responses of these 8 participants to the differentiated version of “Waiting”. As can be seen in the table, the highest average GAS score was 52.50 obtained by Participant 02 and the lowest 45.28 by Participant 23. As in the previous two stories, no single participant scored lower than 45 for the story “Waiting” though average GAS scores of some participants were so close to the marginal score 45. All participants’ GAS scores were improved session by session.

Table 26 Responses of assigned participants for differentiated version of "Waiting"

<table>
<thead>
<tr>
<th></th>
<th>Session 01</th>
<th>Session 02</th>
<th>Session 03</th>
<th>Session 04</th>
<th>Session 05</th>
<th>Session 06</th>
<th>Avg. GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>-2 -1 1 2</td>
<td>-2 -1 1 2</td>
<td>-2 -1 1 2</td>
<td>-2 -1 1 2</td>
<td>-2 -1 1 2</td>
<td>-2 -1 1 2</td>
<td>51.67</td>
</tr>
<tr>
<td>02</td>
<td>1 2 47</td>
<td>3 50</td>
<td>3 50</td>
<td>2 1 53</td>
<td>2 1 53</td>
<td>1 2 57</td>
<td>52.50</td>
</tr>
<tr>
<td>06</td>
<td>1 1 45</td>
<td>2 50</td>
<td>1 2 47</td>
<td>3 50</td>
<td>3 50</td>
<td>2 1 53</td>
<td>49.17</td>
</tr>
<tr>
<td>10</td>
<td>1 2 47</td>
<td>2 50</td>
<td>2 50</td>
<td>3 50</td>
<td>2 50</td>
<td>2 50</td>
<td>49.44</td>
</tr>
<tr>
<td>11</td>
<td>2 1 43</td>
<td>1 2 47</td>
<td>1 2 47</td>
<td>2 50</td>
<td>1 2 47</td>
<td>2 50</td>
<td>47.22</td>
</tr>
<tr>
<td>16</td>
<td>4 1 42</td>
<td>3 3 45</td>
<td>3 4 46</td>
<td>3 4 46</td>
<td>2 3 46</td>
<td>2 3 46</td>
<td>45.74</td>
</tr>
<tr>
<td>22</td>
<td>2 1 42</td>
<td>2 1 45</td>
<td>2 1 46</td>
<td>1 1 46</td>
<td>1 2 46</td>
<td>1 2 46</td>
<td>45.74</td>
</tr>
<tr>
<td>23</td>
<td>2 1 43</td>
<td>1 1 45</td>
<td>2 1 43</td>
<td>2 2 45</td>
<td>1 1 45</td>
<td>2 2 45</td>
<td>45.28</td>
</tr>
</tbody>
</table>

The following is what was observed about these participants’ behavioural responses during the second intervention:

1. Participant 01 was reminded more than once in the first session. Her waiting skill was improved session by session. The same applied to Participant 02, Participant 06 and Participant 10. They became better in waiting. Those 4 participants chose
correct MCQ answers in every session. Some of their negative scores came from their hyper activeness. They were reminded multiple times because they were simply too active to wait.

2. Participant 16 was reminded multiple times in many sessions. He chose MCQ answers correctly half of the time but sometimes he chose the wrong ones intentionally.

3. Improvement of Participant 22 and Participant 23 was quite slow compared to that of other participants in this animated social story. But they chose MCQ answers correctly in most sessions.

Some participants such as Participant 01, Participant 02, Participant 06 and Participant 10 understood the concept completely. Participant 22 and Participant 23 understood partially. Although Participant 16 was easily distracted, his focus was much better in this intervention than in the previous intervention. Based on GAS scores and observation data, all participants seemed to have acquired “waiting” skill with the help of this differentiated animated social story.

5.5.4 Discussion

As in the first intervention, the attraction of tablet computer worked very well. It improved participants’ attentions. The revised scripts were good enough for participants to have a better understanding of the animated social story. The revised gestures worked well for most of the participants and not much for some. Subtitles also improved focuses of participants who can read. It was an unexpected good turn that Participant 04 read subtitles. Her focus improved and she understood concepts of the stories better. Integration of MCQ also helped most of the participants to be able to recall what they had learned which in turn enabled them to apply and behave accordingly. But it did not work for some participants (Participant 06, Participant 16 and Participant 19) who chose answers recklessly. It was obvious that all three
differentiated animated social stories indeed helped most participants to acquire associated social skills.

### 5.6 Data Analysis

It is clear from the tables of scores of both versions of stories (section 5.3 and 5.5) that all modified animated stories worked very well. To get much clearer results, results are compared according to individual social stories in the following sub-sections.

#### 5.6.1 Comparison of the Results of the Generalised and Differentiated Versions

Firstly, the comparison between the generalised and differentiated versions of “Calming Down” can be seen in Figure 51 and Table 27.

![Calming Down](image)

**Figure 51 Comparison of sessional GAS scores of both versions of “Calming Down”**

Figure 51 presents average GAS score of both versions of “Calming Down” according to sessions. Y axis represents average GAS scores gained by the participant population and X axis represents sessions of interventions. According to the figure, there were consistent improvements from session 1 to session 3 of generalised version of the story. As the interests of participants declined, average GAS score for session 4...
slightly declined and the scores were nearly the same in session 5 and 6. Average GAS scores of differentiated version of the story steadily improved significantly from session 1 to 6. From this graph alone, it can clearly be seen that differentiated version of this animated social story is more effective than the generalised version. The detailed comparison of GAS scores can be seen in Table 27.

Table 27 Results comparison of both versions of "Calming Down"

<table>
<thead>
<tr>
<th>Session</th>
<th>Generalised</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Differentiated</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>GAS</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>Session 01</td>
<td>5</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td>38.21</td>
<td>18</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Session 02</td>
<td>4</td>
<td>22</td>
<td>3</td>
<td></td>
<td></td>
<td>39.66</td>
<td>11</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Session 03</td>
<td>23</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>42.58</td>
<td>8</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>Session 04</td>
<td>24</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>42.00</td>
<td>4</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>Session 05</td>
<td>2</td>
<td>17</td>
<td>12</td>
<td>1</td>
<td></td>
<td>43.75</td>
<td>1</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Session 06</td>
<td>2</td>
<td>13</td>
<td>10</td>
<td>1</td>
<td></td>
<td>43.85</td>
<td>20</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>13</td>
<td>122</td>
<td>39</td>
<td>2</td>
<td></td>
<td>250.05</td>
<td>42</td>
<td>117</td>
<td>13</td>
</tr>
</tbody>
</table>

*p value*  

| p value | p < 0.001 |

There were totally 13 times of scoring -2 in the common version but none in the differentiated version. The behaviours which were least expected were no longer observed in the differentiated version. The common version scored 122 times of -1 and differentiated version had 42 times only. The unexpected behaviour rate was down more than 50% in the differentiated version. The score of 0 occurred 39 times and 117 times in the generalised and differentiated version respectively. The rate of expected behaviours rose up in the differentiated version four times much more than in the generalised version. The generalised version achieved the score 1 for 2 times and differentiated version 13. Both versions had no occurrence of scoring 2. The meaning
of $p$ value less than 0.001 is that there was a significant difference between the two sets of scores. The null hypothesis ($H_0$) stated in section 3.4 can be rejected for this story. Since the behaviour changes in the second intervention were positive, it can be concluded that the differentiated story “Calming Down” was able to help the assigned participants better than the generalised “Calming Down”.

Secondly, two sets of the results of the social story “Paying Attention” are compared in Figure 52 and Table 28.

![Figure 52 Comparison of sessional GAS scores of both versions of “Paying Attention”](chart)

Sessional average GAS scores of both versions of “Calming Down” are presented in Figure 52. Y axis represents average GAS scores and X axis represents sessions of interventions. From the figure, it seems that average sessional GAS scores of both versions improved steadily. But if the lines were checked carefully, sessional GAS scores of generalised version improved so slowly that behaviour changes of each participant were very little especially in the sessions 1, 2, 4 and 5 compared to those of the differentiated version. From this graph, it can be seen that the effectiveness of
differentiated version is better than that of the generalised version. Table 28 presents the details of GAS scores of both versions of the social story “Paying Attention”.

Table 28 Results comparison of both versions of "Paying Attention"

<table>
<thead>
<tr>
<th></th>
<th>Generalised</th>
<th></th>
<th>Differentiated</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Session 01</td>
<td>36</td>
<td>6</td>
<td>41.43</td>
<td>18</td>
</tr>
<tr>
<td>Session 02</td>
<td>33</td>
<td>8</td>
<td>41.95</td>
<td>15</td>
</tr>
<tr>
<td>Session 03</td>
<td>32</td>
<td>14</td>
<td>43.04</td>
<td>10</td>
</tr>
<tr>
<td>Session 04</td>
<td>27</td>
<td>18</td>
<td>44.35</td>
<td>8</td>
</tr>
<tr>
<td>Session 05</td>
<td>22</td>
<td>19</td>
<td>44.63</td>
<td>4</td>
</tr>
<tr>
<td>Session 06</td>
<td>19</td>
<td>23</td>
<td>2</td>
<td>46.14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>169</td>
<td>88</td>
<td>3</td>
<td>261.54</td>
</tr>
</tbody>
</table>

| p value | p < 0.001 |

In this story, both versions did not have any occurrence of score -2 and 2. The common version had 169 times of the score -1, 88 times of 0 and 3 times of 1 respectively. The differentiated version, however, had 55 times of the score -1, 116 times of score 0 and 4 times of score 1. Behaviours which were less than expected went down more than 50% in the result of the differentiated version. More expected behaviours were found in the differentiated version although the figure was not clear-cut like “Calming Down”. The same applied to better behaviours which mean more than expected. As in the story, “Calming Down”, p value for this story was less than 0.001. The null hypothesis (H₀) stated in section 3.4 can also be rejected for this story. The behaviour improvements in the second intervention were also positive. The differentiated version of “Paying Attention” helped the participants better than the generalised version in acquiring the skill to pay attention.
Thirdly, results of both versions of “Waiting” are presented in Figure 53 and Table 29. Figure 53 presents sessional average GAS scores of both versions of “Calming Down”. Y axis represents average GAS scores and X axis represents sessions of interventions. As in the story, “Paying Attention”, average sessional GAS scores of generalised version improved steadily but too slowly for the behaviour changes of each participant to be noticed. Due to the reckless MCQ answers of participants, GAS score of differentiated version declined slightly in the third session. Except for that, the improvements of GAS scores were significantly marked in the differentiated version across the sessions. The detail of GAS scores comparison can be seen in Table 29.

Figure 53 Comparison of sessional GAS scores of both versions of “Waiting”
Table 29 Results comparison of both versions of "Waiting"

<table>
<thead>
<tr>
<th></th>
<th>Generalised Animated Social Stories</th>
<th>Differentiated Animated Social Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-2 -1 0 1 2 GAS</td>
<td>-2 -1 0 1 2 GAS</td>
</tr>
<tr>
<td>Session 01</td>
<td>24 1 40.40</td>
<td>14 11 44.40</td>
</tr>
<tr>
<td>Session 02</td>
<td>22 4 41.54</td>
<td>7 17 47.08</td>
</tr>
<tr>
<td>Session 03</td>
<td>21 7 42.50</td>
<td>9 18 46.67</td>
</tr>
<tr>
<td>Session 04</td>
<td>18 8 43.08</td>
<td>6 19 3 48.93</td>
</tr>
<tr>
<td>Session 05</td>
<td>14 12 44.62</td>
<td>5 16 3 49.17</td>
</tr>
<tr>
<td>Session 06</td>
<td>11 13 45.42</td>
<td>16 5 52.38</td>
</tr>
<tr>
<td>Total</td>
<td>110 45 257.55</td>
<td>41 97 11 288.63</td>
</tr>
</tbody>
</table>

\[ p \text{ value} \quad p < 0.001 \]

The common version had 110 times of the score -1 and 45 times of the score 0 but none of the scores -2, 1 and 2. On the other hand, the differentiated version had 41 occurrences of the score -1, 97 of the score 0 and 11 of the score 1. Undesirable behaviours which were less than expected were reduced more than half in the differentiated version. Expected behaviours were doubled and behaviours which were more than expected were found in the differentiated version. The \( p \) value for this story was the same as other modified stories: less than 0.001 and the behaviour changes were also encouraging. It is safe to conclude that the modified version of “Waiting” assisted the participants better than the original version.

5.6.2 Results of Participants Assigned to Both Versions of the Social Stories

To get a better picture of effectiveness of integrating differentiation into animated social stories, results of each participant scored in both versions of animated social stories are presented individually below. Only the results of participants who were assigned to
both versions of stories are compared and discussed to highlight the effectiveness of differentiated animated social stories as opposed to that of common animated social stories. The participants who were in both interventions were Participant 01, Participant 02, Participant 03, Participant 04, Participant 05, Participant 06, Participant 09, Participant 10, Participant 11, Participant 12, Participant 16, Participant 19, Participant 22 and Participant 23. Though data of Participant 06 and Participant 19 of the first intervention were discarded, those data are presented below for individual comparison.

1. Participant 01

Table 30 Results of Participant 01

<table>
<thead>
<tr>
<th></th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Waiting (Generalised)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Waiting (Differentiated)</td>
<td>47</td>
<td>50</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td>1</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 30 illustrates the results of Participant 01 who was assigned to both versions of the story “Waiting”. The Participant 01 was a 12-year-old girl with a speech problem whose primary language was Chinese. As stated in section 5.4, she was one of the participants who barely learnt from the generalised version of “Waiting”. All her sessional GAS scores from the first intervention were below the pass mark, 40, and the scores were not stable. Her scores showed that the generalised version of the story was not able to help her to improve her waiting skill. With the second intervention, her score rose up to 47 in the first session and she was getting better session by session. This mean she did very well in the second intervention. From the scores alone, it can safely be concluded that she had no learning effect of the first intervention.
She scored -1 for 15 times and 0 for 4 times in the first intervention and she did not understand the story very well. According to her class teacher and observation, she did not understand complicated words with long sentences. With the differentiated version, she got -1 for 1 time, 0 for 13 times and 1 for 4 times. Occurrences of the less expected behaviours were down from 15 to 1. More occurrences of expected behaviours were observed. There were times she waited, doing her works quietly. That was where she earned the score 1. She was also able to choose MCQ correctly after one session with the differentiated version.

2. Participant 02

<table>
<thead>
<tr>
<th>Participant 02</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01 S02 S03 S04 S05 S06</td>
<td>-2 -1 0 1 2</td>
</tr>
<tr>
<td>Waiting (Generalised)</td>
<td>40 43 45 45 50 50</td>
<td>6 7</td>
</tr>
<tr>
<td>Waiting (Differentiated)</td>
<td>47 50 50 55 57 57</td>
<td>1 12 6</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td></td>
<td>6 7</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td></td>
<td>1 12 6</td>
</tr>
</tbody>
</table>

Results of the Participant 02 can be seen in Table 31. Participant 02 was a 14-year-old male whose primary language was Bahasa Malaysia according to the pre-assessment, but who understood better in English. He was one of the participants who were able to improve their behaviours through the first intervention (see section 5.4) and his sessional GAS scores from the first intervention also proved that his behaviours for waiting were improved. He had 6 tokens of -1 and 7 tokens of 0 in the first intervention.

In the first session of the second intervention, his performances were poor compared to the last session of first intervention. This shows the 2-month interval to reduce learning effect of the first intervention worked on him (see section 3.1). In the first intervention,
he was observed to process information too slowly to cope with and to understand long sentences. At the same time, according to his teacher and observation, he could learn better by reading than by listening. As a result, he understood the differentiated version of the story with the subtitles better. His attention was more focused compared to the previous intervention. His behaviour was much improved in the second intervention as he only had one occurrence of less expected behaviours, 12 times of expected behaviours and 6 times of behaviours which were beyond expectation. It is tough to conclude that the second intervention alone improved his behaviours because the first intervention also improved his behaviours. It is undeniable that his behaviours, focus and understandings were better with the second intervention.

3. Participant 03

<table>
<thead>
<tr>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>S01     S02  S03  S04  S05  S06</td>
<td>-2</td>
</tr>
<tr>
<td>Calming Down (Generalised)</td>
<td>40</td>
</tr>
<tr>
<td>Calming Down (Differentiated)</td>
<td>48</td>
</tr>
<tr>
<td>Paying Attention (Generalised)</td>
<td>40</td>
</tr>
<tr>
<td>Paying Attention (Differentiated)</td>
<td>47</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td>11</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td>3</td>
</tr>
</tbody>
</table>

Results of Participant 03 are shown in Table 32. Participant 03 was a 12-year-old boy whose primary language was Chinese and secondary language was English. Like Participant 02, he improved his skills on calming down and paying attention through the first intervention. His responses to the first intervention were good as he had a total of 11 occurrences of -1 and 18 of 0 and 2 of 1.
Like Participant 02, the time interval worked on him as well. His scores of the first session of the second intervention were poor compared to the last session of first intervention. His behaviours were better in the second intervention: his undesirable behaviours which were less expected were reduced from 11 to 3 times; his expected behaviours increased from 18 to 27 and behaviours which surpassed expected level from 2 to 9 in total.

4. Participant 04

Table 33 Results of Participant 04

<table>
<thead>
<tr>
<th>Participant 04</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Calming Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Generalised)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Calming Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Differentiated)</td>
<td>45</td>
<td>47</td>
</tr>
<tr>
<td>Paying Attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Generalised)</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>Paying Attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Differentiated)</td>
<td>47</td>
<td>47</td>
</tr>
</tbody>
</table>

Table 33 presents the results of Participant 04. The Participant 04 was 12-year-old girl whose first language was Chinese. She achieved 20 times of the score -1 and 15 times of the score 0 in total for the first intervention where she seemed to have been confused with the gestures of characters and to have lost interest later. Her associated social skills were improved through the first intervention though the pace was quite slow. Like Participant 02 and Participant 03, the time interval worked on her. In the differentiated intervention, she had 7 times of less expected behaviours, 25 times of expected behaviours and 5 times of surpassed expected behaviours. The learning effect from the first intervention might contribute to improvement in her behaviours in
the second intervention. However, her focus was much better with the differentiated versions though she sometime lost focus on animation when she tried some subtitles.

5. Participant 05

<table>
<thead>
<tr>
<th>Participant 05</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Calming Down (Generalised)</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Calming Down (Differentiated)</td>
<td>45</td>
<td>47</td>
</tr>
</tbody>
</table>

The results of Participant 05 are illustrated in Table 34. The Participant 05 was a 15-year-old boy. According to his pre-assessment, his first language was Chinese. But his teacher communicated with him mostly in English. He scored quite low in the first intervention due to his temper. In the last 2 sessions of the first intervention, he had a little control on his temper. There were 2 occurrences of behaviours which were much lower than expected, 17 occurrences of less expected behaviours and 4 occurrences of expected behaviours in the generalised intervention. With the differentiated version, total absence of much less expected behaviours, 3 occurrences of less expected behaviours, most importantly, 14 tokens of expected behaviours and 2 tokens of those beyond expected were observed. In addition to the differentiated intervention, learning effect from the first intervention might help him to improve his behaviours.
6. Participant 06

Table 35 Results of Participant 06

<table>
<thead>
<tr>
<th>Participant 06</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Waiting (Generalised)</td>
<td>43</td>
<td>40</td>
</tr>
<tr>
<td>Waiting (Differentiated)</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 35 presents the results of Participant 06. The Participant 06 was a 15-year-old boy and his primary language was Chinese. His data from the first intervention were discarded because he had only 5 sessions to avoid data imbalance in the analysis for differentiation. However, discussion of the comparison of individual performance between the first intervention and the second intervention is considered significant to better understand the impact of the differentiated social stories on their acquisition of the respective social skill. The comparison table shows that he had five sessions of the first intervention and 6 sessions of the second intervention. It is interesting to see that when the first intervention with fewer sessions had 8 frequencies of less expected behaviour, the second intervention with more sessions had only 2 – less expected behaviour was 75% down. If the differentiated version had not worked for him, logically, there should have been more occurrences of less expected behaviour given one extra session. In addition, there were 13 occurrences of expected behaviours in the second intervention (which had only one extra session) as opposed to 3 in the first intervention and one occurrence of behaviour beyond expectation in the second version as opposed to 0 occurrence in the first version.
Table 36 Results of Participant 09

<table>
<thead>
<tr>
<th>Participant 09</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01  S02  S03  S04  S05  S06</td>
<td>-2  -1  0  1  2</td>
</tr>
<tr>
<td>Calming Down</td>
<td>40   43   45   43   43   40</td>
<td>13  5</td>
</tr>
<tr>
<td>(Generalised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calming Down</td>
<td>44   46   46   46   50   50</td>
<td>9   19   1</td>
</tr>
<tr>
<td>(Differentiated)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td></td>
<td>13   5</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td></td>
<td>9   19   1</td>
</tr>
</tbody>
</table>

The results of Participant 09 are summarised in Table 36. The Participant 09 was an 8-year-old boy. Though his primary language was Chinese according to pre-assessment, he mostly used English. He was one of the participants who did not do well in the first intervention (see section 5.4). From his sessional GAS scores from the first intervention, it is clear that his behaviours were barely improved. As can be seen in the table, occurrences of less expected behaviours decreased - 13 in the first intervention and 9 in the second intervention. In addition, tokens of expected behaviour increased with 5 in the first intervention and 19 in the second intervention. Moreover, while no single behaviour beyond expectation was observed in the first intervention, the second intervention saw 1 occurrence. It is obvious that although less expected behaviours were not reduced significantly, his expected behaviours were doubled in the differentiated intervention. It is also safe to assume that his improvements were due solely to the second intervention.
8. Participant 10

Table 37 Results of Participant 10

<table>
<thead>
<tr>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Calming Down (Generalised)</td>
<td>40</td>
</tr>
<tr>
<td>Calming Down (Differentiated)</td>
<td>43</td>
</tr>
<tr>
<td>Paying Attention (Generalised)</td>
<td>40</td>
</tr>
<tr>
<td>Paying Attention (Differentiated)</td>
<td>45</td>
</tr>
<tr>
<td>Waiting (Generalised)</td>
<td>40</td>
</tr>
<tr>
<td>Waiting (Differentiated)</td>
<td>47</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td>44</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td>10</td>
</tr>
</tbody>
</table>

The results of Participant 10 can be seen in Table 37. The Participant 10 was an 11-year-old girl. Her primary language was Chinese. According to her sessional GAS scores of the first intervention, she did not perform well consistently in all generalised animated social stories and her scores were ranging from 40 to 43. There was no learning effect from the first intervention since she did not do well in the first intervention. No single occurrence of least expected behaviour, beyond expected and much expected behaviour data was observed in both interventions. However, as can be seen in the table, her less expected behaviour decreased from a total of 44 in the first intervention to 10 in the second intervention - with a drop of more than 75% - while expected behaviour increased more than 5 times - from 7 in the first intervention to 37 in the second intervention.
9. Participant 11

Table 38 Results of Participant 11

<table>
<thead>
<tr>
<th>Participant 11</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01  S02  S03  S04  S05  S06</td>
<td>-2  -1  0  1  2</td>
</tr>
<tr>
<td>Calming Down (Generalised)</td>
<td>40  40  43  43  40  40</td>
<td>12  2</td>
</tr>
<tr>
<td>Calming Down (Differentiated)</td>
<td>43  47  47  50  47  50</td>
<td>5  11</td>
</tr>
<tr>
<td>Paying Attention (Generalised)</td>
<td>45  40  47  47  47  47</td>
<td>7  9</td>
</tr>
<tr>
<td>Paying Attention (Differentiated)</td>
<td>43  47  50  50  47  50</td>
<td>4  11</td>
</tr>
<tr>
<td>Waiting (Generalised)</td>
<td>40  45  45  43  45  47</td>
<td>8  6</td>
</tr>
<tr>
<td>Waiting (Differentiated)</td>
<td>43  47  47  50  47  50</td>
<td>5  11</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td></td>
<td>27  17</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td></td>
<td>14  33</td>
</tr>
</tbody>
</table>

Table 38 presents the results of Participant 11 who was a 6-year-old boy. According to the pre-assessment, his primary languages were English and Chinese. He used Chinese mostly for communication. According to his sessional GAS scores from the first intervention, his behaviours were improved in all stories except “Calming Down”. As in the case of Participant 10, no occurrence of least expected behaviour, beyond expected behaviour and much more beyond expected behaviour was observed in both versions of the assigned animated social stories. The 2-month interval worked on him. In the first session of the second intervention, his scores in “Paying Attention” and “Waiting” dropped compared to the last session of the first intervention. His performance in the differentiated version of the social stories was better in comparison with that of the generalised counterparts in terms of frequencies of the occurrence of expected behaviour and less expected behaviour. There was an increase in the occurrence of expected behaviour with 17 in the first intervention and 33 in the second
intervention while there was a drop in the occurrence of less expected behaviour with 27 in the first intervention and 14 in the second intervention. In other words, his less expected behaviour was cut down nearly half and expected behaviour was doubled in the second intervention with differentiated animated social stories. In his case, learning effect might contribute his improvements in “Paying Attention” and “Waiting”. However, his behaviour improvements in “Calming Down” were due solely to the differentiated version of the story since his behaviours were not improved much in the generalised version of the story.

10. Participant 12

<table>
<thead>
<tr>
<th>Participant 12</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Calming Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Generalised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calming Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Differentiated)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paying Attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Generalised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paying Attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Differentiated)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results of Participant 12 are shown in Table 39. He was a 5-year-old boy whose first language was English and who understood Chinese as well. Like Participant 03, he was easily distracted. From his sessional GAS scores of the first intervention, his behaviours seemed to improve in the last session. The 2-month interval faded his learning from the first intervention more clearly compared to that of other participants such as the Participant 02, Participant 03 and Participant 04. It is encouraging to see that while there was a decrease in the occurrence of less expected behaviour with 32
in the first intervention and 13 in the second intervention, there was an increase in the occurrence of expected behaviour with 13 in the first intervention and 32 in the second intervention. Added to his behavioural improvement in the second intervention was one occurrence of behaviour which was more than expected which was not observed in the first intervention. According to the sessional GAS scores from both interventions, it is clear that the second intervention was the main reason of his behaviour improvements.

11. Participant 16

Table 40 Results of Participant 16

<table>
<thead>
<tr>
<th>Participant 16</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Paying Attention (Generalised)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Paying Attention (Differentiated)</td>
<td>43</td>
<td>44</td>
</tr>
<tr>
<td>Waiting (Generalised)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Waiting (Differentiated)</td>
<td>42</td>
<td>45</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td>46</td>
<td>9</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td>29</td>
<td>36</td>
</tr>
</tbody>
</table>

Results of Participant 16 can be seen in Table 40. Participant 16 was a 5-year-old male with a speech issue whose primary language was Chinese. According to his sessional GAS scores from the first intervention, his behaviours were not improved much. In the first intervention, he did not pay much attention to stories and he seemed he was not attracted to the appearance of human characters. In addition, he was observed to like animal characters featured in some education videos. Thus, human characters were replaced with animal characters. Frequencies of occurrence of observed behavioural responses points to the fact that assigned differentiated versions of social stories which featured animal characters enabled him to acquire the related social skills better than
the common version did. While less expected behaviour declined with 46 in the first intervention and 9 in the second intervention, expected behaviour increased 4 times with 9 in the first intervention and 36 in the second. It is clear that his improvements on behaviours and focus were mainly due to the second intervention since his behaviours were not improved much in the first intervention.

12. Participant 19

Table 41 Results of Participant 19

<table>
<thead>
<tr>
<th>Participant 19</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Paying Attention (Generalised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paying Attention (Differentiated)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results of Participant 19 are provided in Table 41. Participant 19 was a 5-year-old boy with limited speech. His primary language was Chinese. This is a case similar to Participant 06 where the comparison of his performance (in both versions of the story “Paying Attention”) is discussed although his first intervention data was not included in data analysis for differentiation. No single occurrence of behaviour which was least expected, beyond expected, much beyond expected was observed in both interventions. Like Participant 06, there were 14 occurrences of less expected behaviour in 5 sessions of the first intervention and 10 occurrences in 6 sessions of the second intervention. In addition, frequencies of occurrence of expected behaviour rose 6 times with 2 in the first intervention and 13 in the second intervention with one extra session. According to the sessional GAS scores of both interventions, the second intervention contributed solely to his behaviour improvements.
13. Participant 22

Table 42 Results of Participant 22

<table>
<thead>
<tr>
<th>Participant 22</th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01</td>
<td>S02</td>
</tr>
<tr>
<td>Calming Down (Generalised)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Calming Down (Differentiated)</td>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>Paying Attention (Generalised)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Paying Attention (Differentiated)</td>
<td>43</td>
<td>47</td>
</tr>
<tr>
<td>Waiting (Generalised)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Waiting (Differentiated)</td>
<td>42</td>
<td>45</td>
</tr>
<tr>
<td>Total Behaviour Responses (All Generalised)</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Total Behaviour Responses (All Differentiated)</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Table 42 compares the results of Participant 22’s performance between two versions of three stories “Calming Down”, “Paying Attention” and “Waiting”. Participant 22 was a 5-year-old male whose primary language was Chinese. It seemed his behaviours were not improved much in the first intervention. His scores were ranging between 40 to 43 except in the last sessions of “Calming Down” and “Waiting” in the first intervention. According to the sessional GAS scores from the first session of second intervention, the 2-month interval was able to fade his learning through the first intervention. No occurrence of least expected behaviour, beyond expected behaviour and much beyond expected behaviour was observed in both versions of these three stories. As in the case of other participants, occurrence of less expected behaviour decreased from 34 in the first intervention to 16 in the second intervention while there was an increase in the occurrence of expected behaviour with 8 in the first intervention and 29 in the second intervention. In other words, with the help of the differentiated version of these three
stories, more than half of less expected behaviours was cut down and expected behaviours increased more than triple.

14. Participant 23

Table 43 Results of Participant 23

<table>
<thead>
<tr>
<th></th>
<th>Sessional GAS Score</th>
<th>Total Behaviour Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S01  S02  S03  S04  S05  S06</td>
<td>-2  -1  0  1  2</td>
</tr>
<tr>
<td>Calming Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Generalised)</td>
<td>40  43  43  40  43  45</td>
<td>11  4</td>
</tr>
<tr>
<td>Calming Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Differentiated)</td>
<td>43  45  47  47  50  50</td>
<td>5  10</td>
</tr>
<tr>
<td>Paying Attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Generalised)</td>
<td>40  40  40  43  43  43</td>
<td>12  3</td>
</tr>
<tr>
<td>Paying Attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Differentiated)</td>
<td>43  43  45  45  50  50</td>
<td>7  9</td>
</tr>
<tr>
<td>Waiting (Generalised)</td>
<td>40  40  40  43  43  43</td>
<td>15  2</td>
</tr>
<tr>
<td>Waiting (Differentiated)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>43  45  43  45  45  50</td>
<td>8  8</td>
</tr>
<tr>
<td>Total Behaviour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responses (All</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generalised)</td>
<td>38  9</td>
<td></td>
</tr>
<tr>
<td>Total Behaviour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responses (All</td>
<td>20  27</td>
<td></td>
</tr>
<tr>
<td>Differentiated)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of Participant 23 in common and differentiated versions of three animated social stories “Calming Down”, “Paying Attention” and “Waiting” are illustrated in Table 43. Participant 23 was a 5-year-old boy with limited speech. His primary language was Chinese. From the sessional GAS scores of the first intervention, he showed not much improvement and his scores were ranging from 40 to 43 except in the last session with “Calming Down”. Like the Participant 22, the 2-month interval was able to fade his learning and his “Calming Down” scores became 43 in the first session of the second intervention. As in the case of Participant 22, no single occurrence of behaviours which were least expected, beyond expected and much more beyond expected was observed in both versions of three animated social stories he was assigned to. Comparison of
the results in the occurrence of least expected behaviour and expected behaviour positively suggests his behavioural improvement in the second intervention with differentiated version of these stories. The least expected behaviour decreased from 38 occurrences in the first intervention to 20 in the second intervention while expected behaviour was tripled with 9 occurrences in the first intervention and 27 occurrences in the second intervention. It is clear that his behaviour improvements were due solely to the second intervention.

5.7 Discussions

As can be seen from the tables of results in the previous sections (see sections 5.3, 5.5 and 5.6), it is obvious that all differentiated versions of animated social stories helped participants acquire associated social skills better than the respective common counterpart of these stories.

Intervention using the common animated social stories failed to assist participants in their acquisition of some social skills because the generalised animated social stories associated with those skills did not meet the needs of participants. When the needs were not met, participants could not understand the social skills presented in those animated social stories. In addition, their interest in those stories was observed to fall gradually. Some participants even lost their interests in the first session. By this way, the participants were pushed away by those common animated social stories instead of learning from them. This called for social stories that would cater to these participants’ needs which in turn necessitated identification of their needs.

The following participants’ needs were gleaned from the results of analysis of observation data from the first intervention using generalised animated social stories and teachers’ feedback:
1. Sentences used in the scripts were wordy and were not short enough for participants such as Participant 05, Participant 09, Participant 10, Participant 12, Participant 15 and Participant 16 to understand.

2. Some gestures of the animation characters confused some participants especially Participant 10, Participant 12, Participant 15, Participant 16 and Participant 17.

3. Some participants such as Participant 15, Participant 16, Participant 17 and Participant 23 preferred animal characters to human animation characters.

4. Some participants such as Participant 02 and Participant 08 learnt better by reading than by listening.

With these learning needs in mind, common animated social stories were differentiated. As stated in section 3.1, using the same participants invited the problem of learning effect. To reduce the risk, the four measures stated in section 3.1 were taken. As the first measure, only generalised animated social stories which failed to help 50% of the assigned participants in acquiring associated social skills were differentiated to reduce the risk of learning effect. Scripts of less successful animated social stories were rewritten concisely to pitch at participants’ comprehensibility. Confusing gestures for participants were revised. The main human character was replaced with the animal character for participants who preferred animal characters. Subtitles were added for visual participants who learned better by reading. Most importantly, MCQ questions were added as on-going assessment for each differentiated social story for parents and teachers to monitor their children’s progress in learning and for children to reflect what they have learnt and be motivated to learn more. In that way, common animated social stories were differentiated according to the learning styles and needs of participants and became differentiated animated social stories. Two-month interval between the two intervention was the second measure to reduce learning effect from the first intervention because generalised animated social stories which failed to help the majority of participants, were able to help some
participants such as the Participant 02, Participant 03, Participant 04, Participant 08 and Participant 12 to improve their behaviours.

Participants who did not understand before came to understand the concepts of the social stories with the help of rewritten scripts. With the aids of revised gestures, some participants understood these animated social stories better. Some participants who were distracted due to the appearance of the characters came to be interested in the stories as they were attracted to the replaced animal character. Participants who learnt better by reading focused better and performed better with differentiated social stories with added subtitles. Participant 04 was exceptional because her desire to read never appeared during observation in the first intervention. Her focus became better and better with reading subtitles in the second intervention.

The tablet computer attracted participants’ attractions and motivated them to learn. The Participant 06 and Participant 19 were eager to touch the tablet rather than learning. That might be the downside of using the tablet computer. More time was needed for participants like them to get familiar with the tablet computer.

Integration of on-going assessments (MCQ) did help most participants to recall the social skills they had learned through these differentiated animated social stories. Some participants showed their interest in SSA and some parents asked about it. They were interested in animation and MCQ features.

Differences in the results between the generalised version and differentiated version of the animated social story “Calming Down” can be seen clearly in Table 27. With differentiated versions, behaviours which were least expected no longer occurred. Less expected behaviours of participants were reduced to 75% and expected behaviours were improved by three times. Behaviours beyond expected occurred more with differentiated versions. The differentiated version of the animated social story “Paying Attention” also reduced participants’ behaviours which were less expected from 169 to
55 (more than 60%) and improved expected behaviours from 88 to 116 times (see Table 28). With differentiated version of “Waiting”, more than 50% of less expected behaviours were cut down and expected behaviours were doubled (see Table 29). Behaviours which were beyond expected also occurred in the differentiated version of “Waiting”. All differentiated versions of animated social stories reduced undesirable behaviours and improved expected behaviours compared to their common counterparts. As stated in section 3.1 and section 3.4, dependent t-test was used as the third measure for the risk of learning effect to show that there were significant differences between the two score set of each animated social stories. As each story’s \( p \) value is less than 0.0001 and the behaviours changes are positive, it shows that the differentiated version of those three animated social stories helped the participants better than the generalise version of the stories.

To get clearer results, individual analysis was performed on the participants who involved in both interventions. According to the score tables (see from Table 30 to Table 43), the participants such as Participant 02, Participant 03, Participant 04, Participant 05 and Participant 12 had learning effect from the first intervention. The second measure, 2-month interval was able to fade the effect to a certain extent. However, the behaviour improvements of participants such as Participant 1, Participant 6, Participant 9, Participant 10, Participant 11, Participant 16, Participant 19, Participant 22 and Participant 23 were due solely to the differentiated versions of the animated social stories.

Based on data analysis and discussion above, the differentiated animated social stories helped participants acquire associated social skills by attracting the attentions of participants to the stories, improving their interests and creating a better understanding of the stories. Tablet computer was useful to attract attentions of participants for the first time and maintained attentions of participants. MCQ helped participants recall what they had learned. These are the proofs which point to the fact that the proposed
approach which integrated differentiated instruction into animated social stories (see section 1.2) worked as expected.

5.8 Summary
This chapter has described how the research was actually conducted. Though there were some unexpected problems such as using 6 sessions instead of 10 sessions of the first intervention and some participants transferred to other schools, the research was conducted successfully according to planned procedures with some minor changes. Observation data of each intervention were presented as clearly as possible. Comparison of results of two interventions in terms of story and individual participants has been described both in text and table to provide a clearer picture of the research outcomes. Details of some data which are needed to know have been rewritten in discussion of the research conduct, results, data analysis and implication of data analysis. The next chapter concludes this report and recommends future works of this research.
Chapter 6: Conclusions

This chapter discusses research contributions and future research works recommended by this research before concluding this research dissertation.

6.1 Research Contributions

The aim of this research was to improve effectiveness of animated social stories and the proposed approach was to integrate differentiated instruction into animated social stories to achieve this research aim. Findings of this research highlights the feasibility of developing social stories, making the best use of attraction that children hold for animation, importance of individual differences in learning social skills, significance of differentiation to reach out every targeted student and influence of IT gadgets on children with ASD. Below are the contributions of this research according to objectives of the research.

- Integrate differentiated instruction into delivering social stories to children with ASD

In order to integrate differentiated instruction into the delivery of social stories to children with ASD, this study took the first step to investigate what has been learnt about children with ASD and their acquisition of social skills. Research into literature related to the behaviours, learning preferences and needs of children with ASD in conjunction with scientific field studies provided a better understanding of the nature of children with ASD and enabled the researcher to identify behaviours that children with ASD were commonly deficient in. Based on data collected in the first step, a prototype, SSA was developed successfully to aid interventions and evaluation. Although SSA was not autonomous, it was definitely a good tool in aiding research processes by serving its purposes (see section 4.1.11). SSA also proved that portability and operating system independency of web technology were useful in special education. Pre-assessment was then conducted with volunteered students who were diagnosed
with ASD (see section 5.1) properly as stated in the proposed approach (see section 1). Data generated from the pre-assessment was used as a basis to develop and assign common animated social stories to respective participants as planned (see section 5.2). The first intervention was made using those animated social stories to find out which worked for these participants and which did not. Using data gathered from the first intervention with common animated social stories, differentiated instruction was integrated into those common animated social stories which did not work (see section 5.4). MCQ was also added as on-going assessment to differentiated social stories.

- Evaluate the effectiveness of differentiated animated social stories in assisting children with ASD in their acquisition of social skills

In order to achieve the second objective, first, the intervention using differentiated animated social stories was implemented. Addition of MCQ to differentiated social stories helped participants to reinforce what they had learned from differentiated animated social stories. The functions of SSA which allow storing MCQ answers and viewing them anytime later highlighted usefulness of web technology. Secondly, results of participants’ performance in common animated social story intervention and the differentiated one were compared (see section 5.6) and the effectiveness of the integration of differentiated animated social stories was evaluated to measure the effectiveness of differentiated animated social stories (see section 5.7) through the performance of the participant population in two versions of each story and through the sessional performance of each individual participant involved in both interventions. The results show that the differentiated version of the three animated social stories were able to help participants acquire associated social skills by getting rid of their least expected behaviours (e.g. getting angry easily) (see Table 27 and Table 34), decreasing their less expected behaviours (e.g. not paying attention even with multiple reminders) (see Table 28, Table 32 and Table 33) and increasing their expected behaviours (see Table 27, Table 28 and Table 29).
• Contribution to science and technology

Findings obtained from the interventions designed in this research show that differentiation in instructions can be adopted in improving behaviours of the children with ASD. When it is adopted in designing the animated social stories, it makes a difference to the social skills improvement process and outcome. It is an important consideration for therapists, special educators and caretakers if they wish to maximize the social skill acquisition of children with ASD. The prototype developed and evaluated in this research also attests to the use of technologies like internet, multimedia and web application as a good behavioural intervention tool for people with cognitive impairments.

6.2 Future Works

Many sections of this research are needed for improvement in future. Most areas which need improvement are the areas which have limitations. In some areas, further research is needed.

In future, prior to any of research processes, small workshops should be conducted to raise the awareness of ASD and recognition of research regarding ASD, significance of sharing knowledge and benefits that research can bring about to help these children.

Recruiting participants presented a significant challenge that this research had to deal with (see section 5.1). In addition to difficulties in finding a sizeable number of possible candidates, getting consents from parents to participate in the research was another limitation. Some parents were afraid that something bad might happen to their children. Getting participants who were fit to take part in the research was another limitation despite having had consents. By raising awareness of ASD, parents may understand more on the research procedures, importance of research and benefits that their
children and they can reap from the research. As a result, parents may feel at ease and this may encourage parents of ASD children to allow their children to join the research.

In future, it is advisable that 2x2 research design should be used to avoid potential learning effect completely and to get clearer results. As stated in section 3.1, this research did not adopt 2x2 research design due to time and resource constraints and the number of participants which did not allow the researcher to divide them into two groups. If there is no such problem in the future search, 2x2 research design is strongly recommended.

The main purpose of the prototype, SSA, is to upgrade the animation feature. According to the users’ feedback (see section 4.1.11), animation feature was not strong enough for users with limited art skills to create good animation. Animation feature can be upgraded to the level whereby teachers can create animation in a few mouse clicks using pre-set animation characters with pre-set animation motions. Pre-set animation characters and pre-set animation motions are animation characters and motions which are pre-set for users to drag and drop. Although technology exists to upgrade, another essential factor is art skill. The researcher of this study did not have necessary art skills to draw pre-set animations characters with pre-set motions and had to use the software to create animation for this research. Collaboration with someone with great art skill is needed for upgrading animation feature of SSA.

This research also recommends that SSA be upgraded to a level in which artificial intelligence (AI) is implemented. The current stage of SSA is completely manual. Pre-assessment can be implemented with AI. Pre-assessment with AI may enable moderator users to explore the background of users. It may allow users to assign users to animated social stories which are considered fit based on the background data. But extensive research on background, preferences and learning styles of children with
ASD is needed to compile data from research to feed into pre-assessment. Then SSA will assign best-fit animation social stories based on input data to the participant.

In addition, there were participants who preferred animal characters more than human characters. But there was no participant who preferred human characters more than animal characters at the same time. It may be very interesting to conduct research on participants with different preferences at the same time for future research.

6.3 Final Conclusions

As mentioned in section 1.3, a combination of animated social stories and an effective teaching method, differentiated instruction, was proposed.

To get clear results of integrating differentiated instruction into animated social stories, two interventions were conducted with the aid of prototype (constructed using up-to-date technologies) running on popular IT gadget, a tablet computer. The first intervention was conducted using common animated social stories to find out which stories did not work out well with most participants. Based on observation data and feedback from teachers, animated social stories which did not work well were differentiated according to the combined teaching method. The second invention was then conducted using modified/differentiated animated social stories. Then, results of two interventions were compared and evaluated. The results clearly highlight that the combination of differentiated instruction and animated social stories worked well.

In conclusion, the findings of this research suggest that differentiated instruction is definitely imperative to meet varying needs of ASD children and maximize their social skills learning potentials through animated social stories. Findings of this study shows that the integration of differentiated instruction into animated social stories helped participants in their social skills acquisitions by eliminating least unwanted behaviours of participants, reducing participants’ behaviours which were less expected at least half of occurrences down, shaping expected behaviours up to mostly double. Although the
results are positive, there is a need to improve the integration of differentiated instruction into animated social stories. There may be more problems/issues which could not be revealed by findings of this study. This research is considered preliminary to investigate integration of differentiated instruction into animated social stories to emerge as a reliable approach to the social skills acquisition of children with ASD.
References & Bibliography


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Additional Readings


Glossary of Terms

Autism Spectrum Disorders: a set of complex brain developmental disorders which cause deficits in social and communication skills.

Baseline: an original state of a certain social skill of a participant before interventions of this study.

Differentiated Instruction: an effective teaching framework which encourages teachers to differentiate instructions to meet the needs of every student in the classroom add in its features.

Differentiated animated social story: an animated social story which is differentiated according to the data from intervention with generalised animated social story to meet the needs of assigned participants to the story to help them acquire associated social skill.

Generalised animated social story: an animated social story which is created to help children with Autism Spectrum Disorders in general (i.e. without targeting any specific group or individual) in acquiring associated social skill.

HTML5: a fifth version of HyperText Markup Language (HTML) which includes “Canvas” element to handle graphical content natively.

Intervention: a process of intervening or treatment to help children with ASD in acquiring social skills.

Mix-mode research design: a combination of qualitative and quantitative approach to evaluate outcomes of research interventions.

Social skills: interactive skills which we acquire by socialising with people in the society, which we use to communicate and significantly build relationship with people in the society.

Social story: a short story used in the Social Story Approach to teach social skills to children diagnosed with ASD; each story presents a certain social situation together with responses from different aspects and gives advice on interactions.

Social Story App (SSA): a web-based software prototype developed in this study to aid in differentiating and delivering processes.
Appendix A Ethical Clearance Approval

SHR Project 2015/225 Ethics Clearance
Keith Williams [kwilliams@swin.edu.au] on behalf of RES Ethics [resehtics@swin.edu.au]
Sent: Friday, September 18, 2015 6:52 AM
To: Bee Theng Lau, Win Ko Min
CC: RES Ethics [resehtics@swin.edu.au]; Jamal Zallini

To: Assoc Prof Bee Theng Lau/Mr Win Ko Min, SUTS

Dear Bee Theng Lau and Win Ko Min

SHR Project 2015/225 Differentiated Instruction for Animated Social Stories: A study on social skills acquisition of children with Autism Spectrum Disorders
Assoc Prof Bee Theng Lau, SARAWhatsApp; Mr Win Ko Min, Mr Ong Chin Ann
Approved Duration: 18-09-2015 To 30-09-2016 [Adjusted]

I refer to the ethical review of the above project protocol by Swinburne’s Human Research Ethics Committee (SUHREC). Your responses to the review, as emailed on 17 September 2015 with attachments, were put to the SUHREC delegate for consideration.

I am pleased to advise that, as submitted to date, the project may proceed in line with standard on-going ethics clearance conditions outlined below.

- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the National Statement on Ethical Conduct in Human Research and with respect to secure data use, retention and disposal.

- The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor requires timely notification and SUHREC endorsement.

- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project. Information on project monitoring and variations/additions, self-audits and progress reports can be found on the Research Intranet pages.

- A duly authorised external or internal audit of the project may be undertaken at any time.

Please contact the Research Ethics Office if you have any queries about on-going ethics clearance, citing the Swinburne project number.

A copy of this email should be retained as part of project record-keeping.

Best wishes for the project.

Yours sincerely,

Keith

----------------------------------------
Keith Williams
Secretary, SUHREC & Research Ethics Officer
Swinburne Research (H818)
Swinburne University of Technology
P.O. Box 218
HAWTHORN VIC 3122
Tel +61 3 9214 5218
Fax +61 3 9214 5267

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## Appendix B Research Timeline

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<td>✓</td>
</tr>
</tbody>
</table>
Appendix C Permission to Conduct Research

Request to Conduct Study

Introduction

We would like to request a permission to conduct a research study at your school (School Name ***). The research title is “Differentiated instruction for Animated Social Stories: A study on social skills acquisition of children with Autism Spectrum Disorders”.

This research is conducted by Dr. Lau BT and Mr. Win KM from Faculty of Engineering, Computing and Science, Swinburne University of Technology Sarawak. The research also contributes to the completion of MSc (by Research) of Mr. Win KM.

The primary purpose of this research is to help children with Autism Spectrum Disorder (ASD) which causes deficiencies in social and communication skills to become full-fledged members of the community by improving their social skills with an aid of technology. This research will employ social story which is considered one of the effective social skill training methods. Animation will be implemented to make the social story more interesting and appealing to children to address an issue of short attention span of these children and readability. Given the advancement in technology and taking advantage of children’s familiarity with electronic gadgets, a tablet PC will be used to present animated the stories to enhance learners’ motivations. This proposed research considers that social story approach will become more effective if it is integrated with differentiated instruction which can accommodate the needs of various individual children with different learning styles who come from different cultural, sociolinguistics and socio-economic backgrounds. In short, this research investigates the effectiveness of differentiated animated social stories.

We hope that you will allow us to invite your students to participate in this research. If permission is granted, the following procedures will be taken throughout the research.

Procedure

1. An informed consent form (attachment) will be distributed to your students through class teachers of those students. As participation is voluntary, students and their parents may sign and return the consent to their class teachers if they are willing to participate. Both students and their parents have the rights to withdraw from the research anytime by informing the researcher face-face-to-face, through telephone or written communication.
2. The researcher will also meet the class teachers to explain the overview and procedures of the research prior to the commencement of the research. To understand the social skills of the participants, the class teachers will be invited to tick a checklist containing a set of common social skills for each participant. Discussions with the class teachers will be conducted by the researcher if further information is needed.

3. Based on the needs of social skills identified by the class teachers in the checklist, a custom set of animated social stories (3 to 5 social stories) will be selected for each participant. The assigned animated social stories will be shown to participants using a tablet computer. At the end of the presentation, each participant will be given a few multiple-choice questions to assess his/her learning of social skills. This is expected to take between 8 – 15 minutes for each of 10 continuous sessions (only one session per day).

4. The researcher will observe participants and take notes of how they demonstrate the social skills acquired in their daily lives at school for 4 weeks. The researcher will be helping as a class assistant throughout the observation.

5. After the observation, animated social stories will be customized according to the needs of each participant. Steps 3 and 4 will be repeated.

6. A research report will be compiled and given to the school as a compliment at the end of the research.

**Benefit**

There are a few significant benefits that the community can have via this research:

1. Teachers and parents are provided with free training and free access to our dedicated online web-based learning portal for more animated social stories.

2. With the access to the portal, participants can learn the social skills anywhere, anytime independently without any guidance from teachers/parents as long as there is an internet access.

3. The access to online web-based learning portal may expose and encourage more teachers and parents to adopt information technology (IT) in special education.

4. The sharing of the research findings through publications can help other ASD children around the world.

5. The research and the findings may be able to provide other ASD researchers with new insights.

**Risk**

The research will only be conducted during the participants’ free slots as provided by class teachers. Thus, the research activities will not interfere with their normal school activities. We will cooperate with class teachers to make sure their learning is not interrupted as each session will only take about 8 – 15 minutes.
With an appeal of animated stories, due care of the researcher and very short duration of each activity, the physical or emotional risk to the participants is deemed low.

Confidentiality

Participation is totally confidential. No participants’ names will appear on any presentation, report or publication of this research. No image, audio and video will be recorded throughout the research. If you have any doubts or questions regarding this research, please do not hesitate to contact the principal researcher: Dr. Lau BT, Tel: 082-260686, Email: hblau@swinburne.edu.my.
Appendix D Permission Granted Letters

PERKATA

SARAWAK ASSOCIATION FOR THE WELFARE OF INTELLECTUALLY DISABLED CHILDREN

13th July 2015

TO WHOM IT MAY CONCERN

This is to certify that Dr. Lau Bee Theng and Mr. Win Ko Min from the Faculty of Engineering, Computing and Science, Swinburne University of Technology Sarawak are given permission to conduct a research study entitled "Differentiated Instruction For Animated Social Stories: A study on Social Skills Acquisition of Children with Autism Spectrum Disorders" at Perkata Special School.

Thank you

Yours faithfully,

Doreen Tie
Principal
Perkata Special School
Dear Win Ko Min,

Re: Request to Conduct Study

On behalf of our centre, I am pleased to inform you that we approve the research study with the title “Differentiated Instruction for Animated Social Stories: A Study on social skills acquisition of children with Autism Spectrum Disorders” to be conducted at our centre upon condition that parental consent of participated students is received.

Thank you.

Yours sincerely,

Ling Shi Ying
Head Teacher
Kuching Methodist Care Centre
Appendix E Research Information State and Informed Consent (Teacher)

Research Information Statement

Project Title

Differentiated instruction for animated social stories: a study on social skills acquisition of children with Autism Spectrum Disorder (ASD)

Introduction

We would like to invite you to participate in a research project that attempts to evaluate the effectiveness of animated social stories integrated with differentiated instruction to help children with ASD in their social skills acquisition.

Researchers involved in this research project

1) Mr Win Ko Min (Masters student, Faculty of Engineering, Science and Computing)
2) Associate Professor Dr Lau Bee Theng (Coordinating Supervisor, Faculty of Engineering, Science and Computing)
3) Mr Ong Chin Ann (Associate Supervisor, Faculty of Engineering, Science and Computing)

Aims of the project

The research aims to help children with Autism Spectrum Disorder (ASD) to acquire social and communication skills which they do not have to become full-fledged members of the community. In order to do so, with the aid of technology, this research integrates differentiated instruction with animated social stories used in teaching social skills to better meet the needs of children with different learning styles, and evaluates the effectiveness of these differentiated animated social stories in comparison with general animated social stories.

What participation will involve

The following are the research activities that you and your student(s) will be involved in:

1) You will be invited to observe and take care of your student(s) together with the researcher.
2) Your student(s) will be involved in 10 sessions of activities conducted in 10 days in both Phase I and Phase II, each of which will take 8-15 minutes. These activities include:
   a) Using a tablet computer, your student(s) will be shown (3-5) animated social stories assigned to him/her/ them. Assignment of social stories is based on your
student(s)’ needs of social skills as identified by you and parents of your
student(s).

b) After the show, your student(s) will be asked a few multiple-choice questions to
understand his/her/their acquisition of the social skills.

3) To make the research activity safe and free from any potential risks for your students,
being sensitive to any signs of discomfort or resistance to research involvement on
the part of the participant children and responding appropriately to such situation is
pivotal. The researcher will be extra careful to monitor such signs and we
will need your cooperation before and during any research activity.

4) Prior to every research session, you will be asked to inform the researcher about
your students’ physical and psychological condition(s). The researcher will proceed
the activities only if you confirm with the researcher that your student(s) is/are
physically and psychologically sound and ready to participate in the research
activities.

5) You will be asked to remind the researcher if your student(s) show(s) any kind of
discomfort with or resistance to the research involvement during the activities. In
such case, the researcher will stop the activities immediately.

6) You will be asked to provide the researcher with suggestion whether a particular
student who shows discomfort or unwillingness to join activities for three sessions
should be excluded from research.

Consent to Participate & Right to Withdraw

The participation of you in this research is entirely voluntary. We would like to have your
informed consent before the research commences. Please carefully consider our request
first. If you agree to participate in the research, please kindly sign the attached ‘Informed
Consent’ and return the signed form to Win Ko Min any time before the commencement of
any research activity.

Even after giving your consent to participate, you still have the right to withdraw from the
research at any time. You may also request that any data collected up to that point be
omitted, returned to you, or destroyed.

As the aim of our research is to help children who need help with social skills acquisition, we
do hope that participation in the research will benefit you and your student(s). Your
contribution and the outcome, that is, findings of this research, will also potentially help other
children improve their social skills.
Privacy and Confidentiality

Researchers make sure that information related to you will be kept strictly confidential by using the following measures:

1) No personal data of yours will appear in any presentation, report or publication of this research. Pseudonym such as Teacher 01, Teacher 02 will be used in the observation notes, oral and written academic report or any research publication.
2) No image, audio or video will be recorded throughout the research.
3) The soft copies of all research data files will be protected with a pass-word known only to the researcher. The observation notes and the back-up disc of the soft copy will be kept in a locked cabinet.
4) All these will be kept for five years, after which they will be destroyed.

Whom to contact

If you have any doubts or questions regarding this research, please do not hesitate to contact:

Associate Professor Dr. Lau BT
Faculty of Engineering, Science and Computing
Swinburne University of Technology
Jalan Simpang Tiga
Tel: 062-260666, Email: blau@swinburne.edu.my.

Mr. Win Ko Min
Faculty of Engineering, Science and Computing
Swinburne University of Technology
Jalan Simpang Tiga
Tel: 01-118511065 (Mobile), Email: wmin@swinburne.edu.my.

Concerns or Complaints about the Project:

This project has been approved by or on behalf of Swinburne’s Human Research Ethics Committee (SUHREC) in line with the Australian National Statement on Ethical Conduct in Research Involving Humans. If you have any concerns or complaints about the conduct of this project, you can contact:

Research Ethics Officer, Office of Research & Graduate Studies (H88), Swinburne University of Technology, P. O Box 218, HAWTHORN VIC 3122.
Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au
Informed Consent Form

Project Title
Differentiated instruction for animated social stories: a study on social skills acquisition of children with Autism Spectrum Disorders (ASD)

Researchers:
1) Mr Win Ko Min (Masters student, Faculty of Engineering, Science and Computing)
2) Associate Professor Dr Lau Bee Theng (Coordinating Supervisor, Faculty of Engineering, Science and Computing)
3) Mr Ong Chin Ann (Associate Supervisor, Faculty of Engineering, Science and Computing)

1. I consent to participate in the project named above. I have been provided a copy of the project "Research Information Statement" to which this consent form relates and any questions I have asked have been answered to my satisfaction.

2. In relation to this project, please circle your response to the following:
   - I agree to observe and take care of my student(s) together with the researcher. Yes  No
   - I agree to allow my student(s) to participate in 20 sessions of watching social stories shown through a tablet computer and answering multiple choice questions related to these social stories. Yes  No
   - I agree to cooperate with the researcher. Yes  No
   - I agree to provide my student(s) physical, psychological and learning conditions before every research session. Yes  No
   - I agree to notify the researcher immediately if my student(s) show(s) any kind of discomfort with or resistance to the research involvement during the activities. Yes  No
   - I agree to help the researcher decide an exclusion of a particular student if he/she shows discomfort or unwillingness to join activities for three sessions. Yes  No

3. I acknowledge that:
   (a) my participation is voluntary and that I am free to withdraw from the project any time without any explanation
   (b) this research project is purely academic and for the purpose of research
   (c) my anonymity is preserved and I will not be identified in any of the researcher’s written or oral report or any research publications

By signing this document I agree to participate in this project.

Signature: ________________________________
Name of Participant: ________________________________
Contact Number: ________________________________
Date: ________________________________
Appendix F Research Information State and Informed Consent (Parents & Children)

Research Information Statement

Project Title

Differentiated instruction for animated social stories: a study on social skills acquisition of children with Autism Spectrum Disorder (ASD)

Introduction

We would like to invite you and your child to participate in a research project that attempts to evaluate the effectiveness of animated social stories integrated with differentiated instruction to help children with ASD in their social skills acquisition.

Researchers involved in this research project

1) Mr Win Ko Min (Masters student, Faculty of Engineering, Science and Computing)
2) Associate Professor Dr Lau Bee Theng (Coordinating Supervisor, Faculty of Engineering, Science and Computing)
3) Mr Ong Chin Ann (Associate Supervisor, Faculty of Engineering, Science and Computing)

Aims of the project

The research aims to help children with Autism Spectrum Disorder (ASD) to acquire social and communication skills which they do not have to become full-fledged members of the community. In order to do so, with the aid of technology, this research integrates differentiated instruction with animated social stories used in teaching social skills to these children to better meet the needs of children with different learning styles, and evaluates the effectiveness of these differentiated animated social stories in comparison with general animated social stories.

What participation will involve

The following are the research activities that you or your child will be involved in:

1) You will be invited to provide the social skills competency of your child using a checklist provided. Informal discussions may be conducted by the researcher if further information or clarification is needed.

2) Your child will be involved in 10 sessions of activities conducted in 10 days in both Phase I and Phase II, each of which will take 8-15 minutes. These activities include:
   a) Using a tablet computer, your child will be shown (3-5) animated social stories assigned to him/her. Assignment of social stories is based on your child’s needs of social skills as identified by you and the class teacher.
b) After the show, your child will be asked a few multiple-choice questions to understand his/her acquisition of the social skills.

3) Daily activities of your child and other participants will be observed by the researcher for 4 weeks to investigate how they demonstrate the social skills that they have acquired after 10 sessions of social story show. During the observation, the researcher will be there as a class assistant to prevent any kind of discomfort on the part of your child.

The research will only be conducted during your child’s free slots as provided by class teachers. Thus, the research activities will not interfere with his/her normal school activities. We will cooperate with class teachers to make sure their learning is not interrupted.

**Consent to Participate & Right to Withdraw**

The participation of you and your child in this research is entirely voluntary. We would like to have your informed consent before the research commences. Please carefully consider our request first. If you agree to participate in the research and grant your child to be involved in the research activities, please kindly sign the attached “Informed Consent” and return the signed form to Win Ko Min any time before the commencement of any research activity.

Even after giving your consent to participate, you or your child still has the right to withdraw from the research at any time. You may also request that any data collected up to that point be omitted, returned to you, or destroyed.

As the aim of our research is to help children who need help with social skills acquisition, we do hope that participation in the research will benefit you and your child. Your contribution and the outcome, that is, findings of this research, will also potentially help other children improve their social skills.

**Privacy and Confidentiality**

Researchers make sure that information related to you or your child will be kept duly confidential by using the following measures:

1) No personal data of yours and your child’s will appear in any presentation, report or publication of this research. Pseudonym such as Participant 01, Participant 02 will be used in the observation notes, oral and written academic report or any research publication.

2) No image, audio or video will be recorded throughout the research.

3) The soft copies of all research data file will be protected with a pass-word known only to the researcher. The hard copy of the checklists filled by you, the observation notes and the back-up disc of the soft copy will be kept in a locked cabinet.

4) All these will be kept for five years after which they will be destroyed.
Whom to contact

If you have any doubts or questions regarding this research, please do not hesitate to contact:
Associate Professor Dr. Lau BT
Faculty of Engineering, Science and Computing
Swinburne University of Technology
Jalan Simpang Tiga
Tel: 082–260688, Email: blau@swinburne.edu.my.

Mr. Win Ko Min
Faculty of Engineering, Science and Computing
Swinburne University of Technology
Jalan Simpang Tiga
Tel: 01-118611085 (Mobile), Email: wmin@swinburne.edu.my.

Concerns or Complaints about the Project:

This project has been approved by or on behalf of Swinburne’s Human Research Ethics Committee (SUHREC) in line with the Australian National Statement on Ethical Conduct in Research Involving Humans. If you have any concerns or complaints about the conduct of this project, you can contact:

Research Ethics Officer, Office of Research & Graduate Studies (H88), Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122,
Tel (03) 9214 5218 or +61 3 9214 5218 or resethco@swin.edu.au
Informed Consent Form

Project Title
Differentiated instruction for animated social stories: a study on social skills acquisition of children with Autism Spectrum Disorders (ASD)

Researchers:
1) Mr Win Ko Min (Masters student, Faculty of Engineering, Science and Computing)
2) Associate Professor Dr Lau Bee Theng (Coordinating Supervisor, Faculty of Engineering, Science and Computing)
3) Mr Ong Chin Ann (Associate Supervisor, Faculty of Engineering, Science and Computing)

1. I consent to participate and allow my child to participate in the project named above. I have been provided a copy of the project “Research Information Statement” to which this consent form relates and any questions I have asked have been answered to my satisfaction.

2. In relation to this project, please circle your response to the following:
   - I agree to fill in the checklist provided by the researchers. [Yes/No]
   - I agree to make myself available for further information if required. [Yes/No]
   - I agree to allow my child to participate in 20 sessions of watching social stories shown through a tablet computer and answering multiple-choice questions related to these social stories. [Yes/No]
   - I agree to allow my child to be observed by the researcher. [Yes/No]
   - I agree to allow the researcher to use the data collected from these activities and to report these data in the written and oral research report or research publication. [Yes/No]

3. I acknowledge that:
   (a) my participation is voluntary and that I am free to withdraw from the project at any time without any explanation
   (b) this research project is purely academic and for the purpose of research
   (c) my anonymity or my child’s is preserved and we will not be identified in any of the researcher’s written or oral report or any research publications

By signing this document I agree to participate and to allow my child to participate in this project.

Signature: ______________________________
Name of Participant: ______________________________
Name of Parent or Guardian: ______________________________
Contact Number: ______________________________
Date: ______________________________
Appendix G Pre-assessment social skill survey form

Checklist for Social Skills Proficiency
Senarai Semak Kebolehan Kemahiran Sosial

Date (Tarikh): .................................. Gender (Jantina): ..................................
Age (Umur) : ..................................

This survey is designed to understand the social skills of children with Autism Spectrum Disorders. The frequency of demonstrating each skill is rated using a 6-point scale from Never (0) to Very Often (5). Thank you so much for your precious time.

Soal selidik ini bertujuan untuk memahami kemahiran sosial kanak-kanak dengan Gangguan Spektrum Autism. Kekerapan demonstrasi setiap kemahiran diberi skala 6 mata dari Tidak Pernah (0) ke Seringkali (5). Ribuan terima kasih kerana meluangkan masa anda yang berharga untuk melengkapkan soal selidik ini.

<table>
<thead>
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<th>No</th>
<th>Language Bahasa</th>
<th>Tidak pernah</th>
<th>Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Malay Language</td>
<td>0</td>
<td>1 2 3 4 5</td>
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<tr>
<td></td>
<td>Bahasa Malayu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>English Language</td>
<td>0</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Bahasa Inggeris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Chinese Language</td>
<td>0</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Bahasa Cina</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Other</td>
<td>0</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Lain-Lain</td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Social skill Kemahiran Sosial</th>
<th>Tidak pernah</th>
<th>Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>He/she controls temper when he/she is in conflict with his/her friends. Dia mengawal perasaan apabila dia mengalami pertengkaran dengan rakan-rakan.</td>
<td>0</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2</td>
<td>He/she introduces himself/herself to strangers without being told. Dia memperkenalkan dirinya kepada mereka yang tidak dikenali tanpa disuruh.</td>
<td>0</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>3</td>
<td>He/she appropriately questions rules that may be unfair. Dia mempersoalkan peraturan yang mungkin tidak adil atau menimbulkan keraguan dengan cara yang sesuai.</td>
<td>0</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>No</td>
<td>Social skill</td>
<td>Never</td>
<td>Very Often</td>
</tr>
<tr>
<td>----</td>
<td>--------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td><em>Kemahiran Sosial</em></td>
<td>Tidak pernah</td>
<td>Seringkali</td>
</tr>
</tbody>
</table>
| 4  | He/she compromises in conflict situations by changing own ideas to reach agreement.  
    *Dia akan bertolak asur dalam situasi konflik dengan mengubah idea asal untuk mencapai persetujuan.* | 0 | 1 2 3 4 5 |
| 5  | He/she responds appropriately to pressures from his/her friends.  
    *Dia memberikan tindakbalas yang sesuai apabila menghadapi tekanan daripada rakan-rakan.* | 0 | 1 2 3 4 5 |
| 6  | He/she says nice things about himself/herself when appropriate.  
    *Dia berupaya memuji perkara yang baik tentang dirinya dalam keadaan yang bersesuaian.* | 0 | 1 2 3 4 5 |
| 7  | He/she invites others to join the activities.  
    *Dia menjemput orang lain untuk menyertai dalam aktiviti-aktiviti.* | 0 | 1 2 3 4 5 |
| 8  | He/she uses free time in an acceptable way.  
    *Dia menggunakan masa lapang dengan cara yang berpatutan.* | 0 | 1 2 3 4 5 |
| 9  | He/she finishes class assignments within time limits.  
    *Dia selesai tugas klas dalam jangkauan had masa yang diberikan.* | 0 | 1 2 3 4 5 |
| 10 | He/she makes friends easily.  
    *Dia mudah berkawan.* | 0 | 1 2 3 4 5 |
| 11 | He/she responds appropriately when he/she is teased by his/her friends.  
    *Dia bertindak balas dengan cara yang sesuai apabila diusik oleh rakan-rakannya.* | 0 | 1 2 3 4 5 |
| 12 | He/she controls temper when he/she is in conflict with adults.  
    *Dia mengawal perasaan marah apabila berlaku peranggahan dengan orang dewasa.* | 0 | 1 2 3 4 5 |
| 13 | He/she receives criticism well.  
    *Dia menerima kritikan dengan baik.* | 0 | 1 2 3 4 5 |
| 14 | He/she initiates conversations with his/her friends.  
    *Dia memulakan perbualan dengan rakan-rakannya.* | 0 | 1 2 3 4 5 |
<table>
<thead>
<tr>
<th>No</th>
<th>Social skill</th>
<th>Never ............... &gt; Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kemahiran Sosial</td>
<td>Tidak pernah--------&gt; Seringkali</td>
</tr>
<tr>
<td>15</td>
<td>He/she uses time appropriately while waiting for help.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia menggunakan masa dengan baik sementara menunggu bantuan.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>16</td>
<td>He/she produces correct schoolwork.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia menghasilkan kerja sekolah dengan tepat.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>17</td>
<td>He/she appropriately tells you when he/she thinks you have treated him/her unfairly.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia memberitahu anda dengan cara sesuai apabila dia fikir anda telah bertindak ke atasnya dengan cara yang tidak adil.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>18</td>
<td>He/she accepts ideas from his/her friends for group activities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia menerima idea-idea untuk aktiviti berkumpulan daripada rakan-rakannya.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>19</td>
<td>He/she praises politely to his/her friends.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia memuji rakan-rakannya dengan sopan.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>20</td>
<td>He/she follows your directions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia menuruti arahan anda.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>21</td>
<td>He/she puts work materials or school property away.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia menyimpan dengan baik bahan kerja atau peralatan sekolah.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>22</td>
<td>He/she cooperates with his/her friends without being prompted.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia bekerjasama dengan rakan-rakannya tanpa diminta.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>23</td>
<td>He/she volunteers to help his/her friends with classroom tasks.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia membantu rakan-rakannya dengan tugas-tugas kelas dengan sukarela.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>24</td>
<td>He/she joins ongoing activity or group without being told to do so.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Dia menyertai aktiviti yang dijalankan atau kumpulan tanpa disuruh untuk berbuat demikian.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>No</td>
<td>Social skill</td>
<td>Never ------------→ Very Often</td>
</tr>
<tr>
<td>----</td>
<td>--------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td></td>
<td><em>Kemahiran Sosial</em></td>
<td><em>Tidak pernah</em> ------------→ <em>Seringkali</em></td>
</tr>
<tr>
<td>25</td>
<td>He/she responds appropriately when pushed or hit by other children. <em>Dia bertindak balas dengan sesuai apabila ditolak atau dipukul oleh kanak-kanak lain.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>26</td>
<td>He/she ignores distractions from his/her friends when doing class work. <em>Dia tidak mempedulikan gangguan daripada rokan-rakannya ketika melakukan tugas dalam kelas.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>27</td>
<td>He/she keeps desk clean and tidy without being reminded. <em>Dia memastikan bahawa mejanya bersih dan kemas tanpa diingatkan.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>28</td>
<td>He/she attends to your instructions. <em>Dia menuruti arahan anda.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>29</td>
<td>He/she makes transition easily from one classroom activity to another. <em>Dia menurut peralihan dari satu aktiviti kelas ke aktiviti yang lain dengan mudah.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>30</td>
<td>He/she gets along with different people. <em>Dia bergaul dengan baik dengan orang yang berlainan.</em></td>
<td>0 1 2 3 4 5</td>
</tr>
</tbody>
</table>
## Appendix H Observation form

<table>
<thead>
<tr>
<th>Section</th>
<th>Social Story</th>
<th>Version</th>
<th>Participant</th>
</tr>
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<tbody>
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</tbody>
</table>

### Data Collection Sheet

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**Note:**
- Fill in the sections as observed.
- Use the provided columns for recording details.
- Ensure all fields are populated as necessary.

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List of Publications

Conference Paper

Win Ko Min, Lau, BT & Ong, CA 2015, ‘Multimedia animations and social skills: A preliminary study on social skills acquisition through animated social stories’, *International Conference on Knowledge and Education Technology 2015*, Langkawi, Malaysia, 9-10 December.

Book Chapter

Win Ko Min, Lau, BT & Ong, CA forthcoming, *Differentiated Animated Social Stories to Enhance Social Skills Acquisition of Children with Autism Spectrum Disorder*, Handbook of Research on Human Development in the Digital Age, IGI Global. [Accepted for publication]