PARENTAL AND ASSISTIVE TECHNOLOGY-BASED EARLY LITERACY INTERVENTION FOR PRESCHOOLER WITH DOWN SYNDROME

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The main purpose of this case study was to explore parental and assistive technology-based early literacy intervention. A preschooler with Down syndrome and his mother were selected to participate in this intervention. Phonological Awareness Literacy Screening for Preschool (PALS-Pre K) was used to test the proficiency of letter knowledge and the beginning sound awareness of this child. The mother then participated in a parental training session and practised the intervention for 3 weeks at home. The results of this study successfully demonstrated an increased level of proficiency in mastering letter knowledge and the beginning sound awareness skills. This article proposes the integration of assistive technology in early literacy intervention as a medium of teaching and learning stimulant to help parents educate their children with more confidence.

Keywords: Parental-based early intervention, assistive technology-based intervention, early literacy, children with Down syndrome

Previous studies have shown that reading is not only a critical skill for success in the field of education, but also important for independent living; many studies have shown that exposure to early literacy will benefit children, whether for typical children or those with disability (Erickson, Hatch, & Clendon, 2010; Trenholm & Mirenda, 2006). In other words, reading skill not only acts as a catalyst for learning in a school environment (Buckley & Bird, 2001), but it is important and will have significant implications in life (Thatcher & Fletcher, 2008).

However, the reading achievements of children with Down syndrome will vary differently (Buckley & Johnson-Glenberg, 2008; Burgoyne et al., 2012). This is caused by factors during the reading intervention approach (Baylis & Snowling, 2012), the influence of home environment (Byrne et al., 2006) and the parents' role in literacy practices at home (Foy & Mann, 2003). In fact, there is still not one strong evidence to show how best to intervene for reading ability (Burgoyne et al., 2012) and mastery of literacy in children with Down syndrome (Martin, Klusek, Estigarribia, & Roberts, 2009).

Past studies show that early intervention is indeed an issue of children and families (Wolery & Bailey, 2002). Furthermore, early intervention programs should focus primarily on strengthening the capacity of parents to increase their child's learning and development. This is because parental based early intervention is more effective in improving parents' confidence and ability to provide opportunity and learning experiences for their children. With this, the benefits of early intervention will be felt by both children and their parents (Dunst, 2007).

Recently, with the rapid development in technology, much attention has been given to its use to help children with disabilities such as those who suffer from intellectual disabilities. Computer technology usage in the teaching and learning process is of undeniable importance. Many previous studies have shown that computer technology can support children in active learning and make it more enjoyable (Steelman, Pierce, & Koppenhaver, 1993); computer-aided learning also stimulates the motivation to learn (Shamir, Korat, & Fellah, 2012).

However, most studies on the effectiveness of early literacy learning technologies such as computer-aided do not focus on children with Down syndrome. Most of the studies involved only typical children and children at risk of having reading problems (Macaruso & Rodman, 2011; Segers & Verhoeven, 2004; Shamir & Shlafer, 2011; Torgesen, Wagner, Rashotte, Herron, & Lindamood, 2010; Wild, 2009).

It is a fact that children with Down syndrome suffer from memory deficits, such as lack of working memory and short audio memory (Bernstein & Tiegerman-Farber, 2009), weaknesses in fine motor tasks (Mon-Williams et al., 2001), non consistent orientation of motivation and a low failure tolerance (Fidler, 2005). These characteristics will affect the level of learning of children with Down syndrome (Bowyer-Crane et al., 2008; Lewis & Norwich, 2005; Nkansah & Unwin, 2010). Hence, it is important to incorporate multi-sensory learning (Shamir et al., 2012), while integrating technology in literacy activities to act as a stimulant to these children.

Therefore, this study intends to use a single subject, multiple baseline research design to investigate integration of assistive technology into the early literacy intervention program, which is being administered by parents to explore early literacy learning of a preschooler with Down syndrome.

Most of the past research that applied single subject research design, however, only involved pre and post-test design, with evaluation conducted immediately after the intervention (Goetz et al., 2008; Lemons, Mrachko, Kostewicz, & Paterra, 2012; van Bysterveldt, Gillon, & Foster-Cohen, 2010). Because of this methodological weakness, the design is unable to reveal the durability, continuity, and sustainability of the treatment effects. Thus, this study also aims at assessing the sustainability of the early literacy skills after the intervention throughout the 7 weeks maintenance stage. This is done by performing a delayed post-test after the said period.

PURPOSE AND OBJECTIVES

This study was conducted to investigate the early literacy interventions that integrated the assistive technology in the teaching and learning process. The intervention was done by a parent who had been trained by the researcher on early literacy skills of children with Down syndrome. The study was guided by the following objectives:

1. To explore the literacy achievement of a child with Down Syndrome after the early literacy intervention
2. To explore the views of the parent toward parental and assistive technology based early literacy intervention.

RESEARCH QUESTIONS

The study was conducted in order to answer the following research questions:

1. What is the proficiency level of early literacy skills of a child with Down syndrome after early literacy intervention?
2. What are the parent's views toward parental and assistive technology based early literacy intervention?

DELIMITATION

This parental based early literacy intervention was administered by parents in a home environment. The target of this study is a preschooler with Down syndrome. Assistive technology used in this study refers to a portable computer, namely the iPad and the software application downloaded via iTunes. Early literacy in this paper covers beginning sound awareness skills and letter knowledge skills, such as uppercase naming, lowercase naming, as well as letter sounding. Based on the pre-test results, the target letters in this intervention involved only the letters "M, m, P, p, I, i, H, h, A, a, T, t" and a reference to the letter sound. Furthermore, only part of the intervention was reported with data of only one participant included.

METHODOLOGY

Research Design

A case study which applied the "Embedded" mixed method (Creswell & Clark, 2011) was used to investigate the proficiency level of the study sample's early literacy skills and parent's view on parental and assistive technology based early

literacy interventions. Hence, the quantitative and qualitative data were collected concurrently during the intervention process. In this study, a single-subject research design was used to answer research question number one. Particularly, the intervention involved three different phases: baseline, intervention and maintenance to indicate effectiveness of the treatment (Barlow & Hersen, 1984; Gast, 2010; Shaughnessy, Zechmeister, & Zechmeister, 2009). In addition, a qualitative approach was later used to answer research question number two.

Participant

In this study, a preschooler with Down syndrome and his mother were selected as participants to carry out this early literacy intervention. The sample was selected based on the following pre-determined criteria: (a) the child had to be aged between 4 and 6 years old, (b) the child is able to participate in all early literacy intervention sessions, (c) no significant eye problems such as cataract, (d) no serious hearing problems, such as middle ear infections, (e) no neurological disorders, sensory or behaviour problem such as hyperactivity, (f) able to speak and communicate in simple sentences that contain at least 2 to 3 words, (g) involved in preschool programmes in government special needs preschool or any early intervention centres of non-governmental organisations around Kuala Lumpur and Selangor, (h) the child is able to read correctly at least one word or identify a single letter. A child who was able to recognize more than 20 letters of the alphabet was excluded from the study.

Description of Participant

Sensen is a boy with Down syndrome. He was 4 years 8 months when the intervention began. Sensen has problems of speech delay, with an inner ear condition. He was first suspected of having a middle ear infection; however, after several tests and observations, doctors confirmed that he does not suffer from any form of infection. This was later confirmed during his Audiometry test by another doctor. From the aspect of fine motor development, Sensen is capable of holding a pencil correctly. However, he is not yet able to write any letters.

From the aspect of cognitive function, the observation data revealed that Sensen has a deficit in verbal short-term memory. In his case, he was unable to immediately recall what has been read back. However, Sensen is strong in his visual-motor integration. He was able to learn through imitating the movement of others.

From the aspect of language use and mastery, Sensen's receptive language development is much higher than that of his expressive language. However, Sensen's level of understanding still needs improvement. Repetitions are recommended to ensure Sensen receives the information passed to him. His clarity of speech is still limited because of facial muscle weakness. However,

Sensen is capable of saying two to three words in a simple sentence. The main communication language in his home environment is English.

From the personality aspect, Sensen is a very friendly child with Down syndrome. He loves to smile and socialises easily with other people. However, as a child with Down syndrome, Sensen also has difficulty in focus of attention. His concentration is short and easily interrupted by things happening around him. Furthermore, Sensen has low tolerance of failure; he will often abandon the task given if he thinks it is difficult to perform. He often gets tired easily when given learning tasks. Typically, the determination to learn will diminish day by day. For example, he has a higher passion for learning on Monday, but his determination would decrease by more than half by Friday. Moreover, he frequently yawns during the learning process.

As for English literacy, Sensen had been taught to read using the whole-word approach in a special school. Besides that, he had been taught the knowledge of letters, especially the name of the letter. However, the results of the pre-test baseline indicate that Sensen still could not identify the name of uppercase and lowercase letters correctly. In addition, he also does not have confidence in naming the known letters. Sensen is also unable to produce any letter sound. At the beginning of the sound awareness test, Sensen was completely unable to the complete the test successfully. This might be because he has not been exposed to the initial phoneme detection exercise yet.

Sensen's mother is a housewife. Her highest education level is SPM. She has never been exposed to reading through the phonological awareness or phonics approach. From the aspect of literacy practices at home, Sensen's mother never carried out any formal literacy activity with her son, except to assist him in his schoolwork. During the process of sample selection, Sensen's mother was not confident to teach her son early literacy skills. In addition, she also thought she might not be able to control her son's behaviour.

Setting

The intervention program was implemented in a home-based environment. Thus, interventions were carried out on a one-to-one basis by the mother to the child.

Instrumentation

For Pre Intervention

A home literacy survey form was distributed to parents of potential children through government special needs preschools or private early intervention centres around the Selangor and Kuala Lumpur area. Only one preschooler with Down syndrome who matched the criteria will be selected. After that, a letter of consent was signed by the mother to ensure she is able to follow through the intervention process. A treatment fidelity checklist was later conducted to ensure that the mother was able to implement the intervention after training. In this study,

the parent was required to score 90% or greater in a fidelity checklist prior to completing the training. A pre test was also done to assess the selected child's level of early literacy skills and determine the targeted letters that will be taught in the intervention.

For Intervention

In this intervention study, an Individual Lesson Plan (ILP) is designed based on the findings of past studies. The primary guide for this intervention plan is the model used by Al Otaiba, Schatschneider, and Silverman (2005). Subsequently, the lesson plan, scope, teaching activities and steps were adapted from various sources, namely Stepping Stones to Literacy (Nelson, Benner, & Gonzalez, 2004), The Gillingham manual: Remedial training for children with specific disability in reading, spelling, and penmanship (8th ed., Gillingham & Stillman, 1997), the Phonological Awareness Literacy Screening Pre-K Teacher's Manual (Invernizzi, Sullivan, & Meier, 2004), the Bringing the Montessori Approach to Your Early Years Practice (Isaacs, 2010) and life experiences of the writer teaching children with special needs.

The ILP was designed based on several considerations. First, the model of Al Otaiba et al. (2005) demonstrated one-to-one approach as the more effective method in teaching reading skills. Second, the major step in the intervention plan was adapted from instructional procedures proposed by Nelson et al. (2004), involving three main steps: (1) Instructor's demonstration, (2) Children learn together with the instructor, and (3) Children show skills that were taught independently. Third, the learning approach was based on the recommendations of Gillingham and Stillman (1997), which emphasize learning phonics through a multi-sensory approach. Moreover, planning of lesson activities and steps, the use of teaching aids and time distribution were proposed based on the recommendation by Invernizzi et al. (2004), Isaacs (2010) and the researcher's own experience of teaching children with Down syndrome.

For Post Intervention

After the intervention, a parent survey form was completed by the mother. The purpose of the survey is to determine whether the intervention is feasible and effective. In addition, the survey also intends to investigate the parent's perspective, whether the targeted skills are important, and whether the preschooler demonstrates improvement after the intervention. The evaluation questions use a 6-point scale (1-strongly disagree, 6-strongly agree) to assess parent's acceptance of the intervention program. The mother completed a survey that evaluated the following:

1. The targeted skills are important for my child.
2. The intervention was effective at teaching targeted skills to my child.
3. The progress made by my child when she or he received the intervention was meaningful.

4. My child benefited academically from the intervention.
5. I would like to continue using the intervention used in this study with my child.
6. I think the intervention is an effective intervention for children like my child.
7. I think the intervention could be implemented by other parents.
8. The intervention strategies were acceptable to me.
9. I could implement this intervention with currently available resources.
10. I will continue using this intervention.

Early Intervention

The early literacy intervention consists of three main skills to be learned. The first two skills include letter knowledge, namely letter names and letter sounds, and training of beginning sound awareness. Both of these skills are grouped into phase one of the intervention. The third skill to be learned is word reading skills, which is categorised into phase two of the intervention.

The total sessions for the intervention lasted 15 to 30 minutes per day, five days a week, for five consecutive weeks to learn the targeted early literacy skills. The intervention involved only the training of letter name, letter sound and beginning sound awareness for the first three weeks to learn six selected letters. The following two weeks involved reading words phonologically. This is where the child has to apply, practice and master the skills learned during the phase two intervention.

During the intervention, the participant will only learn two new letters every week. The participant will repeat the learning of names and sounds of the same letters over a five day period. The set of six letters to be learned by the participant consists of "a, t, b, i, m, p," over a combined period of three weeks. The first session named "I Spy Letter & Sound", focuses on training in the letter name and sound. The second session, called "I Spy Sound in Word", focuses on training recognition of beginning sound of a word.

Other than that, the handling of activities, materials and time interventions were flexible and are designed for modification by any parent at home based on their child's needs.

Data Collection Techniques

The pre-test, immediate post-test and delayed post test were used in order to collect information to answer the first research question about the level of proficiency of letter knowledge skill and beginning sound awareness skill of the respondent after the early literacy intervention. The pre-test and immediate post-test were used to evaluate the performance of the study sample's letter knowledge

skill and beginning sound awareness skill. The delayed post-test, however, was used to investigate the sustainability of both skills long after the intervention. The assessment tool used in this study was the Phonological Awareness Literacy Screening for Preschool (PALS-PreK; Invernizzi et al., 2004). Test components of the PALS-PreK that were adapted and used for the dependent variable data measurement included "PALS-PreK Letter naming", "PALS-PreK Letter Sound" and "PALS-PreK Beginning Sound". The test was repeated three times during each pre-test, immediate post-test and delayed post-test to ensure the reliability and validity of the results.

Furthermore, a parent survey, passive participation observation (Spradley, 1980) and an interview method were used to obtain the parent's view on the integration of assistive technology in parental based early literacy interventions. Validity and reliability of this qualitative data was conducted via triangulation between method and member check (Merriam, 2009; Noraini, 2010). The primary data is the transcript data from the interview with the parent, while the secondary data were obtained from the observation during the intervention and the responses from the parent survey form. The feedback from the interview and observation were documented by the researcher.

Data Analysis

Procedure for the quantitative data analysis of this study is by visual analysis of the graph (McGrill-Franzen & Allington, 2011). Comparison of the scores between phases (baseline, intervention and maintenance) is done to identify the proficiency level of the preschooler. The qualitative data analysis procedure of this study, meanwhile, involved three stages. In the first stage, data from observation and interview will be transcribed into written form. In the second stage, a set of open codes is developed from the data. In the third stage, axial coding is done to group all the open codes into relevant categories and themes (Merriam, 2009; Patton, 2002).

RESULTS

Sensen's Early Literacy Skills Mastery after Intervention

Pre-test results show that Sensen was able to name correctly a few letter names shown to him. However, his naming skills are still not consistent. He also was unable to produce any letter sounds and could not complete the beginning sound awareness assessment. Scores for these three assessments are shown in Table 1. Based on the pre-test results, he is able but not consistently to name the uppercase 'G, O, B, D' and also the lower case 'g, o, d, e'.

After three weeks of early literacy intervention, the immediate post-test was carried out to determine Sensen's level of proficiency in letter knowledge and beginning sound awareness skill. Overall, Sensen has shown a change in trend

achievements for the targeted early literacy skills. The result also indicated an increased level of early literacy skills, the skills of letter naming, letter sounding and skill of beginning phoneme detection. Later, a delayed post test was carried out after seven weeks to investigate whether Sensen is still able to sustain the skills being trained. Results revealed that Sensen is still able to maintain all the skills even though the intervention was terminated.

Table 1
Pre- Test Results on Letter Knowledge and Beginning Sound Awareness Assessment

Early Literacy Skills	Scores		
	Assessment 1	Assessment 2	Assessment 3
Uppercase letter naming	4/26	2/26	1/26
Lowercase letter naming	4/26	3/26	2/26
Letter sounding	0/26	0/26	0/26
Beginning sound awareness	0/26	0/26	0/26

Specifically, the immediate post-test results reveal that Sensen shows more consistency in naming uppercase letters than when naming lowercase letters. The result found that Sensen has successfully mastered all six uppercase names of the letters "M, P, T, A, H, I" being taught on all three immediate post-tests. However he was only able to correctly name all six lowercase, "m, p, t, a, h, i" two out of three times in the immediate post-test. Although Sensen showed an increase in his level of letter sounding ability, he was only able to produce four out of six letter sounds correctly in two out of three times immediately after the post test. In the beginning of the sound awareness assessment, the results also showed an increase in Sensen's level of beginning sound awareness skills. He was able to identify the sound of the initial phoneme for a total of 11 words being read during the last two immediate post-tests. During the immediate post-test, Sensen was asked to produce the initial phoneme sound of all the words. As an example, / m / for the words / mouse / and / monkey /; / p / for the words / pot / and / popcorn /; / t / for the words / turtle / and / top /; / i / for the words / ink / and / igloo /; / a / for the words / airplane / and / ant / and / h / for the words / hair / and / house /.

Lastly, the results from the delayed post test revealed a stable trend of achievement in Sensen's early literacy skills. Furthermore, results revealed that Sensen was able to maintain his early literacy skill level even after the intervention had ended. In this maintenance phase, he was able to name all the letter names consistently, including all uppercase and lowercase. Similarly, he was able to produce all six letter sounds taught confidently, namely "/ m /, / p /, / t /, / a /, / h /, / i /". Besides that, at the last delayed post-test, Sensen was able to produce the initial phoneme sound of all the words being tested. Changes in Sensen's level of mastery for each early literacy skill at pre-test, immediate post test and delayed post-test respectively, are as shown in Figure 1 and Figure 2.

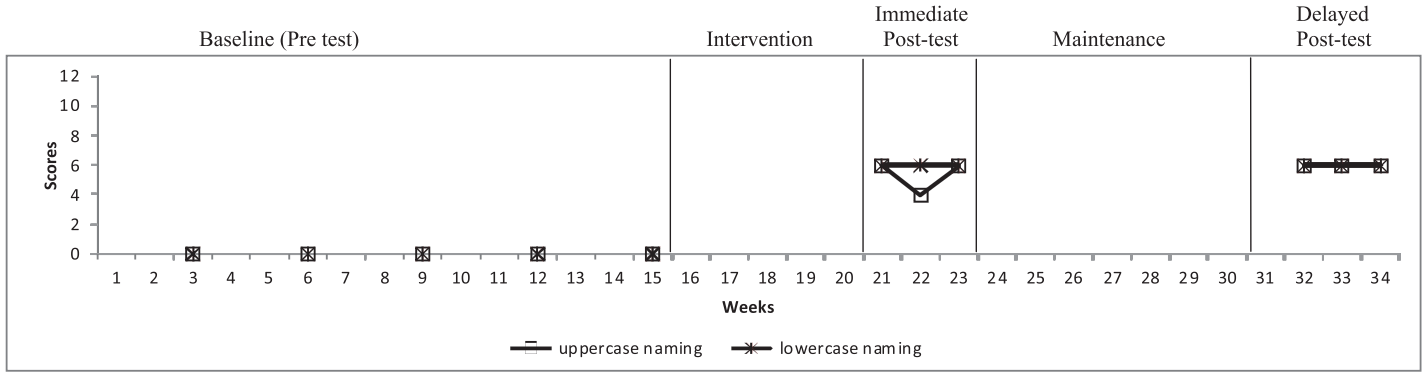

Figure 1. Sensen's Changes of Mastery Level in Uppercase Naming and Lowercase Naming Skills

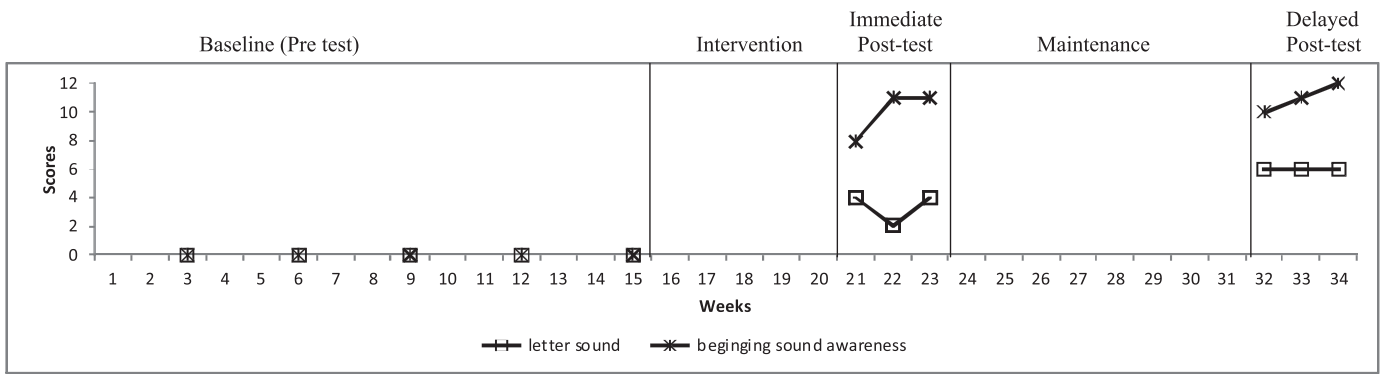

Figure 2. Sensen's Changes of Mastery Level in Letter Sound and Beginning Sound Awareness Skills

Parent's View on Parental and Assistive Technology Based Early Literacy Intervention

Sensen's mother reported on the parent survey that she strongly agreed the targeted skills in this intervention were important to her child. She also agreed that this intervention was effective in teaching the targeted skills to her child. She also reported that she agreed that the progress made by her son after receiving the intervention was meaningful. Overall, she reported that she agreed that her son benefited academically from the intervention. In addition, she agreed that she was able to accept the planned intervention strategy and was able to implement this intervention with the current available resources. She concluded and agreed that the intervention was an effective intervention for children like her son and easily implemented by other parents. Confidently, she expressed intention to continue implementing the intervention beyond and after the study.

A semi structured interview data from the parent was obtained to further explore the parent's view on the integration of assistive technology in parental based early literacy intervention. There are three main themes derived from the data.

Assistive Technology as Teaching and Learning Medium

For both the mother and Sensen, the iPad assistive technology was able to serve as a useful learning tool in this intervention. Sensen's mother agreed that the use of iPad was suitable in the literacy intervention conducted. In her early school days, she was never exposed to the phonics approach. Now, with the assistance of the iPad technology, she is able to learn and master these early literacy skills in a simple and easy way before teaching her son.

> M: 父母也学习到咯！对，可能父母的年代没有 phonic 嘛.可以自己先学。简单又容易。
>
> (*Parents also can learn! Right! During parent schooling days, don't have phonic. Can learn myself first. Simple and easy.*)
>
> (Mother Sensen, Interview)

> *During the parent training session, Sensen's mother was able to learn and practice the letter sound via the 'ABC Magic' application*
>
> (Observation Field note, training, Sensen's mother)

Second, the iPad also has elements that are attractive to children. Additionally, these tools are already in existence in the lives of today's children. Learning will be more interesting if you can incorporate the iPad as a medium. Therefore, Sensen's mother perceived that the use of iPad as a learning tool can stimulate learning and help her son master early literacy skills that is taught in this literacy intervention.

M: 因为 ipad 比较生动吧, 然后是现在的小孩子都会用 ipad 。它已经出现在他们的生活当中。

(*Because the iPad is more interesting. Nowadays, all the children know how to use the iPad. It is already very visible in their daily lives.*)

(Sensen's Mother, Interview)

Sensen showed expressions of happiness and excitement when his mother began on the writing application. Mom used this application to teach Sensen the name and sound the letters while tracing letters. Mom still needed to assist Sensen to trace. Sensen was engaged and can follow mother's instruction.

(Observation Field note, it1w2d4, abc123)

Meaning of Learning

According to Sensen's mother, the use of the iPad in this early literacy intervention program also successfully provided her son with the meaning and concepts of learning through iPad. Before the intervention began, the iPad only works as a tool of entertainment for Sensen. Sensen often used iPad to surf YouTube and watch *Barney & Friends*. However, after the intervention, Sensen often will use the iPad as a learning tool, open learning applications such as "abc" to learn the letter name and sing-along "abc" song.

M: em...ah...现在他...以前拿ipad，他只是看YouTube，但是现在拿ipad, 我有那些 words 是写的，他至少自己都会 click 进去，去写 abc，对对对，ah... 不是说 ipad 只是用来玩，可以 学习到认字，认认认那个形状这个样子。

(*em ... ah ... now, he... before this, when he took the iPad, he would just watch YouTube, but now whenever he take the iPad, at least he himself will click into the program, to write ABC. Yes ... not to say iPad just served to play, but can also learn to read, recognize the shape, something like this.*)

(Sensen's Mother, Interview)

Developing Confidence

Sensen's mother also noticed immediately after the intervention, that her son had become more confident and was able to call out the letter names and letter sounds loud and clear. Besides that, Sensen's mother also expressed more confidence in her son's learning abilities. She also mentioned that she was able to manage her son in a formal literacy activity, which she thought was impossible before this intervention. With the guidelines provided, she was able to implement the intervention based on her child's needs.

M: 嗯，现在他的讲话也大声了。以前就很小声，几乎没有什么听得到。至少那些 /m/ 啊，/h/ 啊，他就比较，这些 words 的音准就比较准确。他会了，他可以了。我知道这个，这个，这个，这个字，这个音怎样读，/m/，/a/... 信心也提高了。

(*Ah, and now he can speak more loudly. Before this, his voice very soft, almost cannot hear. At least those / m / ah, / h / ah, all this words, the articulation is more accurate. He knows he can do it. He himself know this, this, this, this word, this sounds how to read, / m /, / a / ... confidence level also improved.*

(Sensen's Mother, Interview)

M: 比较清楚孩子的学习进度到哪里。到哪里，对对对。当我自己又再教他 letter 和 sound，然后就在平时他自己又学习，到现在他讲得出字母，confidence 是说, eh..... 他是可以的 。eh..... 原来就 ...eh..1 再帮助他一下，原来他是可以的。

(*More clearly about the child's learning progress. Until where? Oh yes…. When I teach him letter and sound, he will practice by himself. Now he can name the letters confidently, that I can say, ... he can. ..... with little help for him, actually he can do it.*)

(Sensen's Mother, Interview)

M: 现在这个我自己教，也看得到他的那个，eh...他们的习惯，然后父母就要想办法去怎样去克服。

(*Now, I have to teach myself. I can observe him.... his habits, then as a parent, we need to find a way on how to solve problems*.)

(Sensen's Mother, Interview)

After the intervention, the mother told the researcher that before this intervention, she thought she was unable to control her son in such formal activity.

(Observation Field note, t1w2d1, Sensen's mother)

The mother was more confident in implementing the intervention, handling all the activities well and was able to make some modification to the process when Sensen was not in focus.

(Observation Field note, it1w3d3, Sensen's mother)

During post-test, when asked to name and sound the letters, Sensen confidently name and sound all the letters he knows out loudly. Furthermore, during the beginning of the sound awareness assessment,

he was able to respond and produce the initial phoneme sound quickly and loudly. Compared to during the pre-test, Sensen's voice was very soft, until sometimes he cannot be heard.

(Observation Field note, post-test, Sensen)

DISCUSSION

The primary objective of this study was to explore the effectiveness of the parental based early literacy intervention that integrates assistive technology. Overall, this study successfully demonstrated there was a significant increase in the level of achievement of early literacy skills of the study sample. In particular, the findings of this study show that the study participant managed to master all the skills of letter naming, letter sounding and beginning sound awareness. This finding is consistent with previous researches that found children with Down syndrome are able to master most of the literacy skills such as letter knowledge in a short time (Burgoyne et al., 2012). This finding further supports that although children with Down syndrome have deficits in aspects of short-term working memory (Bernstein & Tiegerman-Farber, 2009), with the assistance of parents and assistive technology, they can master the literacy skills that were previously considered to be difficult for them.

The second objective of this study was to explore the views of the parent regarding the integration of iPad as an assistive technology in parental based early literacy intervention. The findings of this study have shown that the parent was willing to adjust the activity for the child and felt confidence in her ability to continue implementing the intervention beyond the study. In this case, the use of the iPad has played an important role as a medium for teaching and as well as a learning aid.

Looking from the aspect of the iPad as an assistive technology device for teaching, the iPad has shown to be a very important tool. The results from this study have shown that with the presence of the iPad and the software that supports its usage, research sampel with non consistent orientation of motivation and with low tolerance towards failure were able to complete each task successfully and was fully involved in each of the activities. The children are attracted to the visual, auditory and interactive component of the assistive technology that inherently promotes active learning among children (Steelman et al., 1993). Moreover, computer technology can also function as a catalyst to motivate learning experience among children (Shamir et al., 2012).

Adding to that, the research findings showed that while the research sample is using the iPad, even when making mistakes he does not run away or flee from the task he is performing. This finding coincides with past research that computers are able to respond in a "non threatening" way, unlike a human response that may illicit emotional stress from the children (Blok, Oostdam, Otter, & Overmaat, 2002).

From the aspects of assistive technology usage, the iPad, as a teaching medium, has shown that Sensen's mother was able and successfully mastered letter sound skill that was unknown to her before using the iPad. Before performing the intervention on her son, Sensen, the mother had mastered all the letter sounds with the help of the iPad software. Furthermore, Sensen' mother was able to adapt the intervention program to suit the skill and ability of Sensen. Even though Sensen's mother is a housewife and with no prior experience in teaching early intervention, she was able to perform each component of the early intervention program smoothly. Towards the end of the early intervention program, Sensen's mother was able to confidently deliver each ILP with the assistive technology of the iPad. This result is in parallel with the findings of Duff et al. (2008) who stressed that with adequate training and support, early intervention can be done by non- professionals, including parents.

Furthermore, with the findings of the existing data, further improvements of the ILP will be made to produce a module which can be used not only by parents, but also by guardians and caregivers, and lastly, teachers of preschool special education.

CONCLUSION

The study has proven that with parental training and suggested materials, the parent was able to play an important role in conducting the early literacy intervention with confidence. Overall, it can be concluded that these assistive technology devices not only serve as a learning aid for the subject samples, but has become the learning medium for the mother of the child to learn early literacy skills before teaching her son. Moreover, to a mother who has never been exposed to such teaching approach, confidence in educating her son on the knowledge of letters has increased with the integration of such assistive technology.

The existence of such assistive technology has certainly opened new avenues for educators and researchers to develop new approaches to help students with disabilities learn more effectively. Furthermore, the technology has the characteristics of a mobile, touch screen, easy to use and interactive applications to incorporate various combinations of learning techniques, namely the technique of sight (visual), auditory techniques and kinesthetic techniques (Fernald, 1943). Some of these techniques are commonly used in the teaching of reading remedial students.

Besides that, this study also found that the effects of the intervention were not just about improving the early literacy skills of a child with Down syndrome but the quality of the relationship and the bonding between mother and child observed. This intervention also showed that the mother became more confident about her child's progress, and is able to manage the child's behaviour during study time. All this means a lot to a mother, who before this was only relied on teachers for feedback.

Finally, a major limitation of this study is that it involved only one subject as the sample. But it gives the opportunity to explore in detail the response of the preschooler with Down syndrome on the use of assistive technology in early literacy intervention by parents. It is recommended that further research on early literacy intervention with the help of this technology applied by the parents be carried out to strengthen the findings of this research.

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