**“Maternal scaffolding of preschoolers’ writing using tablet and paper-pencil tasks:
Relations with emergent literacy skills”.**

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Abstract

Mothers play a key role in scaffolding children's writing using traditional tools such as paper and pencil. However, little is known about how mothers scaffold young children's writing using touch screen tablets (e.g., iPads) and the associations between maternal scaffolding and emergent literacy. Mother-child dyads ($N = 47$; M child age = 3.43 years) were video recorded as they wrote words using an iPad and a paper and pencil. Maternal print and grapho-phonemic mediation behaviours were measured. Children were assessed on letter name and letter sound knowledge, letter writing and name writing, and print concepts. No significant differences were found in the level of maternal mediation provided in the tablet or paper-pencil condition. Maternal print mediation was positively associated with letter name and letter sound knowledge and emergent writing in the tablet and paper-pencil conditions. Grapho-phonemic mediation was significantly related to children's understanding of letter-sound correspondence and print concepts in the paper-pencil condition, but not the tablet condition. Supporting parents in using grapho-phonemic mediation during tablet use to foster early literacy learning should be considered in future research.

Keywords: Touch screen tablet, iPad, joint writing, scaffolding, emergent literacy, preschoolers, early childhood education.

Introduction

Young children's exploration of print, mark making, and concepts about writing emerge early in life (Clay, 1975; Levin & Bus, 2003; Puranik & Lonigan, 2011; Yamagata, 2007). Through socio-cultural interactions with their world (Vygotsky, 1978) children learn that print communicates meaning and they begin experimenting with their own representations of letters and words (Diamond, Gerde, & Powell, 2008; Levin & Bus, 2003; Tolchisky, 2003). Children engage in a wide range of writing activities such as pretend writing, name writing, invented spelling, and copying environmental print (Baghban, 1984, 2007; Burns & Casbergue, 1992; DeBaryshe, Buell & Binder, 1996; Neumann & Neumann, 2010). In this 21st century young children use digital (laptop, touchscreen tablet; Crescenzi, Jewitt, & Price, 2014; Livingstone, Marsh, Plowman, Ottovordemgentschenfelde & Fletcher-Watson, 2014; Rideout, 2011) and non-digital (e.g., paper, pencils, crayons) writing tools (Mayer, 2007). Both have the potential to influence young children's early literacy learning and experiences (Neumann, Finger, & Neumann, in press).

In addition to the type of writing tool, guidance from an adult is an important factor that influences early literacy experiences and development (Gerde, Bingham, & Pendergast, 2015; Hall, Simpson, Guo, Wang, 2015; Yost, 2003). **Within each literacy interaction, parents can provide guidance as necessary to scaffold the child's movement within their Zone of Proximal Development, which is the space between a child's level of mastery with and without assistance (Vygotsky, 1978). For example, it has been shown that using lines to represent letters (Neumann & Neumann, 2010) and words (Bodrova and Leong, 1998) helped scaffold preschoolers' writing, moving them within their Zone of Proximal Development. Parents may also scaffold young children's writing of letters and words to extend them within their Zone of Proximal Development. Aram and Levin (2002) found that when mothers used higher levels of scaffolding (e.g., word segmenting, retrieval of**

letter shapes) during joint writing activities with their kindergartners there was a positive effect on children's word writing and recognition and phonological awareness. Through guided assistance, young children learn to physically form letters and words, understand that print travels in a linear pattern from left to right, and develop their knowledge of letter-sound connections (Mayer, 2007). The presence of a more knowledgeable adult to help scaffold (Wood, Bruner, & Ross, 1976) children's use of writing tools during joint writing activities (e.g., word writing) has been shown to foster literacy learning (Aram & Levin, 2001; Baghban, 1984; Bloodgood, 1999; Burns & Casbergue, 1992; Mayer, 2007; Neumann & Neumann, 2010; Skibbe, Bindman, Hindman, Aram, & Morrison, 2013).

Previous research has suggested that writing is a challenging task for young children because it requires a range of print and orthographic knowledge (Puranki & Lonigan, 2011). Parent mediation during joint word writing can support early writing by guiding children in segmenting words, making letter-sound connections, and letter formation (Aram, 2007; Aram, 2010; Aram, Most, & Mayafit, 2006; Burns & Casbergue, 1992). Studies using paper-pencil writing tools (Aram & Levin, 2002, 2004; Levin & Aram, 2012; Neumann, Hood, & Ford, 2012; Skibbe et al., 2013) have measured parent mediation during joint writing activities using a *print mediation* scale and a *grapho-phonemic mediation* scale. The print mediation scale examines scaffolding of letter shaping and varies from low (no assistance), medium (parent writes the letter for the child to copy), and high (parent encourages and monitors the child to write the letter; Aram, 2007; 2010). The grapho-phonemic scale examines scaffolding of letter-sound retrieval and varies from low (no assistance), medium (parent dictates the letter name), and high (parent helps the child retrieve the letter sound; Aram, 2007, 2010).

The level of maternal mediation during joint writing of words using traditional writing tools is positively related to emergent literacy ability (Aram & Levin, 2001, 2002; Aram et al., 2006; Neumann et al., 2012). Furthermore, maternal mediation in preschool predicts conventional skills such as spelling, reading, and comprehension at grade 2 (Aram & Levin, 2004). Skibbe et al. (2013) observed 77 US parents and preschoolers (*M* age = 4.62 years old) engaging in a joint writing activity (writing a birthday invitation) twice within a one year period. Children's emergent literacy skills were measured at both time points. Grapho-phonemic mediation predicted decoding (letter and word identification) and phonological awareness skills but not vocabulary skills. Print mediation predicted decoding skills but not phonological awareness or vocabulary skills. Overall, parents on average dictated each letter name and wrote each letter for their child to copy.

In contrast to work on parent mediation with paper-pencil, little is known about how mothers use digital writing tools to scaffold young children's emerging letter and word writing (Aram & Bar-Am, 2015). Aram and Bar-Am (in press) videorecorded 49 mothers and their preschoolers (Mean age = 5.32 years) in family homes writing a shopping list using a paper and pencil and laptop computer keyboard. Maternal print and grapho-phonemic mediation were coded and children were assessed on spelling ability. The style of maternal mediation of spelling was found to be consistent across both paper-pencil and computer tools. However, the authors found that higher levels of grapho-phonemic and print mediation were used to assist spelling in the computer keyboard condition than in the paper-pencil condition. It was suggested that this finding may be influenced by the letters being visible on the keyboard. These visual graphic cues may have allowed children to better focus their attention on making letter-sound connections. It is possible that the features of typing and deleting letters via the keyboard may afford less printing effort than using paper and pencil. The

authors highlighted the potential benefits of using computer keyboards to foster joint writing activities in conjunction with traditional activities.

New digital technologies such as touch screen tablets (e.g., iPads) that do not require the fine motor skills to operate a mouse and keyboard are becoming increasingly popular amongst young children (Marsh et al., 2015; Merchant, 2015). Parent surveys have shown that two-thirds of children aged 3 to 5 years have access to touch screen tablets (Neumann, 2014, Australia; Ofcom, 2014, UK). A tablet's user friendly touch based multisensory interface and interactive applications (apps) provides young children with a tool for mark making, creating and exploring writing (Neumann & Neumann, 2015). Through tablets children have access to a range of drawing and painting apps (e.g., Brushes, Doodle Buddy, Drawing Pad; Marsh et al., 2015), writing apps (e.g., Write my name, Little writer, Little speller; Neumann, 2014) and story creation apps (e.g., Draw and tell, New booth app; Marsh et al., 2015).

Only a few studies to date have examined young children's digital writing with touch screen tablets (Neumann & Neumann, 2016; Wollscheid, Sjaastad, Tómté, Lóver, 2016). A recent review by Wollscheid, Sjaastad, and Tómté (2016) revealed that there is currently mixed or no conclusive or consistent evidence that either digital or non-digital writing tools favour early writing outcomes. However, observational work has shown potential benefits of tablets for early writing. Tablets and writing apps (e.g., iWrite) can engage preschool children in drawing, creating messages, stories and self-portraits, name writing, and typing texts (Beschorner & Hutchison, 2013; Bigelow, 2013). In these studies, children were competent in using Doodle Buddy to make marks on the screen by selecting colours, changing brush sizes, and using undo and erase functions. These interactions were fostered by teachers who scaffolded preschoolers' digital writing experiences by asking questions (Beschorner & Hutchison, 2013) and providing positive encouragement (Bigelow, 2013).

Wood, Petkovski, DePasquale, Gottardo, Evans, and Savage (2016) observed parent-child general interactions ($N = 104$; child age range: 46-75 months) with tablets and showed that tablets were a positive and engaging learning tool. Parents used verbal (providing instructions, asking questions, clarifying), physical (holding the iPad, pointing to the screen, assisting with pressing) and emotional (positive feedback, praise, encouragement) behaviours to support young children's interactions with tablets. Nevski and Siibak (in press) collected survey data on 198 parents who used touch screen devices at home with their children aged 0 to 3 years. The authors reported parents using a range of mediation strategies such as restrictive mediation (on time used and content), active mediation (discussing content, explanation, instructions), and technical mediation (monitoring use) to assist their children during their interactions with these devices at home.

To date, no study has explored maternal scaffolding of young children's writing using a touch screen tablet or the relationship between this maternal mediation and with emergent literacy skills. The present study examined these questions by asking parent-child dyads to engage in a joint writing task using a touch screen tablet. Based on previous joint writing research with paper-pencil (Aram & Levin, 2001; Skibbe et al 2013) it was hypothesised that positive associations would be found between print and grapho-phonemic maternal mediation emergent literacy skills (letter name and letter sound knowledge, name writing, letter writing, print concepts). It is unknown how maternal mediation behaviours will differ when using a touch screen tablet for writing when compared to traditional writing tools. For this reason, the parent-child dyads were also asked to complete the same writing task using a paper and pencil. Differences in maternal utterances (total maternal utterances/total time on task) and maternal affective feedback (e.g., "well done") were examined to determine if parent scaffolding differed between these digital and non-digital writing tools.

Method

Participants

Forty-eight children (22 boys; 26 girls) from six child care centres in South East Queensland, Australia and their mothers participated in this study. One child's data was excluded because he did not complete the paper-pencil activity, leaving a final sample of 47 mother-child dyads. All the children (M age = 3.43 years; SD = .76; range = 1.98 to 4.59 years) were English speaking and had no developmental or learning delays as reported by mothers. The average family socio-economic status (Mean SES = 45.74; SD = 9.57; range = 20.5 to 59.5) was calculated based on parent education and occupation. The mean fell within the middle SES range (8-66; Hollingshead, 1975).

Procedure

University research ethics and permission from the child care centre managers was obtained. Mothers provided written consent for their child to participate and completed a home questionnaire on family demographics (e.g., parent education and occupation) and child information (e.g., age). In one session, each mother and child dyad completed the joint writing tasks in a quiet room at the child's centre. On the same day as the joint writing tasks each child was assessed on emergent literacy skills (print concepts, letter name and letter sound knowledge, letter and name writing) by a trained researcher. Children were provided with a complimentary story book at the end of the study.

Joint writing task

Each mother and child sat side-by-side at a table and the mother was provided with this instruction from the researcher: "There will be two writing tasks for you to do with your child. The first task is to use the iPad and *Draw Buddy* app (Byte By Byte LLC., 2014) to help your child write the words JUMP and RABBIT. When you have finished this I will give you a paper and pencil to write the words JUMP and RABBIT. I would like your child to do

the writing but you can help in any way that you like and I will let you know when to begin”.

The researcher video recorded the session and remained in the room.

Writing tools

The *Draw Buddy* (Byte By Byte LLC., 2014) app was downloaded to an iPad Air 2 device. This app was selected because it provided a simple and easy to use digital version of a traditional blank paged writing pad with no distractions and animations present. In addition, similar types of apps have been used in previous studies that have explored young children's use of iPads for drawing and writing (Beschoner & Hutchison, 2013; Bigelow, 2013; Crescenzi et al., 2014). The *Draw Buddy* app can be used to draw pictures, make marks, and write letters and words on the touch screen interface using a finger. The interface has a white background with one far side of the screen containing a selection of colours and an eraser. The other side of the screen consists of four icons with various functions (new, undo, settings, save). A colour can be selected by tapping it and then the user can write on the screen using their finger. In the paper-pencil task, an A4 size blank sheet of white paper and a pencil was used.

Measures

Joint writing mediation behaviour

Each mother-child joint writing session was fully transcribed verbatim by a trained research assistant then print mediation (maternal scaffolding of letter shaping) and grapho-phonemic mediation (maternal scaffolding of letter-sound connections) was coded and scored using a reliable scale (Aram 2007, 2010; Levin & Aram, 2012). Print mediation was scored on a scale of 0 (no assistance e.g., allows child to scribble randomly) to 4 (Child shapes the letter correctly on his/her own with the mother's encouragement: The mother helps the child complete the whole writing process actively encouraging the child to write independently, whilst monitoring the child along the steps through positive feedback and encouragement; see

Table 1). Grapho-phonemic mediation was scored on a scale of 0 (no assistance e.g., child scribbles randomly) to 7 (Child retrieves and writes the correct letter sound/name on his/her own with the mother's encouragement: The mother helps the child complete the whole writing process actively encouraging the child to encode independently, whilst monitoring the child along the steps through positive feedback and encouragement; see Table 2). **If more than one maternal mediation behaviour was observed for any given letter, the highest level of scaffolding was scored.** If a letter was written more than once, the letter was scored at the highest scaffolding level the mother used for that letter. Each letter score was added, then an average score across the 10 letters that were written was calculated.

Similar to Aram (2010)'s scoring of positive maternal reinforcements (e.g., "good", "very nice"), the frequency of maternal affective feedback provided by mothers during the tablet and paper-pencil joint writing tasks was measured by counting up the total number of affective utterances (e.g., "good job", "wow", "nice one") made during each task and dividing it by the total time (measured in minutes). The frequency of maternal utterances that occurred during the tablet and paper-pencil joint writing tasks was measured by counting the total number of maternal utterances made during each task and dividing it by the total time. A maternal utterance is defined as a stretch of speech that has a period of silence or change of speaker before and after it (Crystal, 2008; Ninio & Bruner, 1978; Neumann & Neumann, 2016). For example, the following was divided into three utterances: / alright/ hold the pencil/ you're going to do that letter/.

The author scored all of the 47 mother-child transcripts for maternal behaviour in the tablet and paper-pencil condition. Similar to previous joint writing studies (Aram, 2002; Aram & Levin, 2002), 25% of the sample were randomly selected to determine inter-rater reliability. A trained research assistant not involved in the data collection scored the transcripts ($n = 12$). Inter-rater reliability was determined by comparing the scores of the two

judges (author and research assistant) on this subsample. The inter-rater reliabilities were acceptable for the tablet condition: Print mediation ($r = .85$), grapho-phonemic mediation ($r = .81$), affective feedback ($r = .93$), maternal utterances ($r = 1$). The inter-rater reliabilities were also acceptable for the paper-pencil condition: Print mediation ($r = .92$), grapho-phonemic mediation ($r = .92$), affective feedback ($r = .93$), maternal utterances ($r = .99$). As both the scores were similar between the two judges, the author's scores were used for all transcripts.

Table 1 *Print mediation scale (maternal scaffolding of letter shaping)*

Behaviour	Point scale
Mother allows child to scribble randomly with no assistance.	0
Mother holds/guides the child's hand to shape the letter or helps the child trace letters by doing dots in shape of letter.	1
Mother writes the letter for the child to copy.	2
Mother scaffolds the child's letter shaping verbally using directional and/or descriptive language (e.g., " <i>M</i> goes up, down, up, down"; "It's like a circle and a line", mother traces letter on the page with a finger, or mother writes it in the air).	3
Child shapes the letter correctly on his/her own with the mother's active encouragement.	4

Table 2 *Grapho-phonemic mediation scale (maternal scaffolding of letter sound connections)*

Behaviour	Point scale
Mother allows the child to scribble randomly with no assistance.	0
Mother silently holds/guides the child's hand to write or does dots for child to trace letter.	1
Mother silently writes the letter for the child to copy.	2
Mother dictates the letter name for child to write.	3
Mother says the letter sound for the child to write or says a word starting with the letter (e.g., "B for Book").	4
Mother says the letter sound and letter name linking them together (e.g., P says Puh).	5

Mother encourages the child to retrieve the letter sound and helps the child to link it to the letter name (e.g., “What do you hear next? Listen carefully to the sound”).	6
Child retrieves and writes the correct letter sound/name on his/her own with the mother’s active encouragement.	7

Letter name and letter sound knowledge

Each child was presented with cards printed with 26 upper case letters and 26 lower case letters in random order. Children were asked to provide the name and the sound of each letter. Each correct answer scored 1 point for upper and lower case letter name (max = 52) and upper and lower case letter sound (max = 52).

Letter and name writing

Each child was asked to write their name on a blank sheet of A4 paper with a pencil. No scaffolding or assistance was given. A 7 point scale [0 = *no production*, 1 = *random scribbling*, 2 = *controlled scribbling (e.g., dots, lines)*, 3 = *random letter-like forms (pseudo-letters)*, 4 = *strings of non-phonetic conventional letters or the first letter of their name*, 5 = *some correct letters of name*, 6 = *name writing generally correct*, 7 = *name written and spelled correctly*] adapted from Bloodgood (1999) was used to score name writing (max = 7).

Children were provided with a blank sheet of A4 paper and a pencil and asked to write each of the 26 letters of the alphabet that was dictated by the researcher. No scaffolding or assistance was given. Either upper case or lower case letters written in conventional form based on Schickedanz and Casbergue’s (2009) examples of written letters were accepted with repeated letters scored once only (Max score = 26). Inter-rater reliability was determined by selecting a random sample of 25% of participants. This sample was independently scored by a trained research assistant and the author. As both letter writing ($r = .95$) and name writing ($r = .96$) scores showed high inter-rater reliability, the author’s scores were used.

Print concepts

Ten questions adapted from Clay's (2005) *Concepts about Print* test assessed children's print concepts (e.g., what is a letter and word, left-right directionality) using a story book (*Follow Me Moon*; Clay, 2009). Children scored 1 point for each correct response (max = 10) with the test showing acceptable internal consistency (Cronbach's $\alpha = .79$).

Results

Comparison of Mediation Behaviour

The descriptive statistics for maternal print mediation and grapho-phonemic mediation, affective feedback, and maternal utterances for tablet and paper-pencil conditions are reported in Table 3. To complete the writing of JUMP and RABBIT, mothers on average spent 5.03 minutes using the tablet and 3.65 minutes using paper and pencil. Mothers provided on average 1 positive feedback (e.g., "you're clever", that's beautiful, I am very proud of you) per minute when using each writing tool. The frequency of maternal utterances provided to children were similar across the tablet (27 per minute) and paper-pencil (26 per minute) conditions.

Table 3. *Descriptive statistics for maternal print mediation, affective feedback, and maternal utterances for tablet and paper-pencil writing tools: Mean (Standard Deviation, Range)*

Maternal Behaviour	Writing Tool	
	Tablet	Paper-Pencil
Print mediation	2.28 (0.67, 1 - 3.9)	2.36 (0.80, 1 - 4)
Grapho-phonemic mediation	3.10 (0.73, 1 - 4.9)	2.95 (0.83, 1 - 5.40)
Affective feedback/min	1.28 (1.07, 0 - 4.45)	1.82 (1.57, 0 - 7.03)
Maternal utterances/min	27.61 (7.97, 10.74 - 50.76)	26.05 (8.48, 5.04 - 42.73)
Total affective feedback	6.34 (5.16, 0 - 22)	6.57 (5.54, 0 - 23)
Total maternal utterances	138.38 (53.39, 35 - 294)	94.43 (43.07, 19 - 183)
Total time spent writing (mins)	5.03 (1.34, 2.03 - 9.82)	3.65 (1.21, 1.11 - 6.76)

To examine differences between using a tablet or paper-pencil on print mediation, grapho-phonemic mediation, affective feedback, and maternal utterances, separate repeated measures ANCOVAs were conducted controlling for child age. All the analyses were not significant, $F_s < 1$ and $p_s > .05$, indicating no differences between maternal behaviours in the tablet or paper-pencil condition (Print mediation $F(1, 45) = 0.35, p = .55, \eta_p^2 = .008$; Grapho-phonemic mediation $F(1, 45) = 0.02, p = .88, \eta_p^2 = .001$; Affective feedback $F(1, 45) = 0.99, p = .32, \eta_p^2 = .02$; Maternal utterances $F(1, 45) = 0.07, p = .80, \eta_p^2 = .001$).

Table 4 shows the percentage of mothers who engaged in each print mediation behaviour. On average mothers wrote each letter for their child to copy when using either the tablet or paper-pencil with over half of mothers writing the letters for children to copy and less than 20% of mothers scaffolding children's letter shaping using directional language (e.g., T goes down and across). Mothers used a similar level of grapho-phonemic mediation across both writing tools namely dictating each letter name. Table 5 shows that few mothers (less than 11%) said the sound of each letter when helping their child write a word with no mothers encouraging children to retrieve the next sound in a word. A sample of joint writing of the words JUMP and RABBIT using the tablet and paper-pencil by the mother and child is shown in Figure 1. Mothers generally wrote the words JUMP and RABBIT for the child to copy when using either the tablet or paper-pencil.

Table 4. *Percent of mothers engaging in each print mediation behaviour for tablet and paper-pencil (N = 47)*

Behaviour	Tablet (%)	Paper-pencil (%)
Mother allows child to scribble randomly with no assistance.	0	0
Mother holds/guides the child's hand to shape the letter or helps the child trace letters by doing dots in shape of letter.	16	19
Mother writes the letter for the child to copy.	68	55
Mother scaffolds the child's letter shaping verbally using directional and/or descriptive language (e.g., "M goes up, down, up, down"; "it's like a circle and a line"; mother traces letter on the page with a finger, or mother writes it in the air).	16	19
Child shapes the letter correctly on his/her own with the mother's active encouragement.	0	7

Table 5. *Percent of mothers engaging in each grapho-phonemic mediation behaviour for tablet and paper-pencil (N = 47)*

Behaviour	Tablet (%)	Paper-pencil (%)
Mother allows the child to scribble randomly with no assistance.	0	0
Mother silently holds/guides the child's hand to write or does dots for child to trace letter.	4	8
Mother silently writes the letter for the child to copy.	32	33
Mother dictates the letter name for child to write.	53	53
Mother says the letter sound for the child to write or says a word starting with the letter (e.g., "B for Book").	11	2
Mother says the letter sound and letter name linking them together (e.g., P for Puh).	0	4
Mother encourages the child to retrieve the letter sound and helps the child to link it to the letter name (e.g., M: "What do you hear next? Listen carefully to the sound").	0	0
Child retrieves and writes the correct letter sound/name on his/her own with the mother's active encouragement.	0	0

Figure 1. Mother-child joint writing of 'JUMP' and 'RABBIT' using a tablet (a) and paper and pencil (b)

The descriptive statistics for the emergent literacy measures are presented in Table 6. Children knew twice as many letter names than letter sounds and overall their letter knowledge was limited. Most children were unable to write their name, producing mainly random letter-like forms. These findings aligned with letter writing ability with children on average being able to write three conventional letters. The majority of children had some understanding of print concepts such as directionality and concepts of a letter and word.

Table 6. *Descriptive statistics for emergent literacy skills (N = 47)*

Measure	Mean (Standard Deviation, Range)
Letter name ^a	8.83 (14.98, 0 – 52)
Letter sound ^a	3.47 (8.41, 0 – 38)
Name writing ^b	3.17 (1.99, 1 – 7)
Letter writing ^c	2.89 (4.37, 0 – 18)
Print concepts ^d	3.17 (2.43, 0 – 9)

Note: Maximum test score: ^a = 52; ^b = 7; ^c = 26; ^d = 10

Correlational Analyses

Print mediation, grapho-phonemic mediation, maternal affective feedback, maternal utterances, print concepts, and name writing were normally distributed. Letter name knowledge, letter sound knowledge, and letter writing required a logarithmic transformation to normalise the distribution. Child age was positively associated with all measures and was controlled for by partialling age out of the correlational analyses. Correlations between maternal print mediation, grapho-phonemic mediation, affective feedback, and maternal utterances for maternal joint writing with the tablet are shown in Table 7. In the tablet condition, print mediation was related to letter name knowledge, letter sound knowledge, letter writing, and name writing skills; however, no positive associations occurred between grapho-phonemic mediation and affective feedback and emergent literacy skills.

Correlations between maternal print mediation, grapho-phonemic mediation, affective feedback, and maternal utterances for maternal joint writing with paper and pencil are shown in Table 8. In the paper-pencil condition, maternal print mediation was related to all emergent literacy skills and grapho-phonemic mediation was related to print concepts and letter sound knowledge. Affective feedback was related to print concepts.

Table 7. *Tablet correlations between maternal print and grapho-phonemic mediation, affective feedback, maternal utterances, and emergent literacy skills, controlling for child age.*

	1	2	3	4	5	6	7	8
1. Print mediation	-							
2. Grapho-phonemic Mediation	-.04	-						
3. Affective feedback/min	.42**	.27	-					
4. Maternal utterances/min	.42**	.32*	.66**	-				
5. Letter name	.35*	.01	.26	.04	-			
6. Letter sound	.29*	.03	.08	-.03	.77**	-		
7. Name writing	.41**	-.16	.16	.05	.61**	.50**	-	

8. Letter writing	.42**	-.07	.26	-.00	.84**	.71**	.77**	-
9. Print concepts	.18	.19	.21	.01	.40**	.14	.28	.39**

*p<.05, **p<.01

Table 8. *Paper-pencil correlations between maternal print and grapho-phonemic mediation, affective feedback, maternal utterances, and emergent literacy skills, controlling for child age.*

	1	2	3	4	5	6	7	8
1. Print mediation	-							
2. Grapho-phonemic mediation	.40**	-						
3. Affective feedback/min	.33*	.12	-					
4. Maternal utterances/min	.37*	.21	.26	-				
5. Letter name	.56**	.27	.20	.21	-			
6. Letter sound	.50**	.31*	.00	.09	.77**	-		
7. Name writing	.34*	.10	.05	.12	.61**	.50**	-	
8. Letter writing	.58**	.29	.26	.16	.84**	.71**	.77**	-
9. Print concepts	.47**	.34*	.30*	.22	.40**	.14	.28	.39**

*p<.05, **p<.01

Discussion

Due to the increasing use and popularity of touch screen tablets by young children it is important to examine parent-child interactions with these tools. The present study extends research on joint writing (Aram & Bar-Am, in press; Skibbe et al., 2013) in younger children by examining maternal use of a tablet to support children's writing. Mothers were observed to easily adapt to the tablet by providing a similar level and type of scaffolding for their child as shown with traditional paper-pencil tasks. Across both types of writing tools mothers rarely provided higher levels of grapho-phonemic mediation, such as helping children connect letters to sounds.

Maternal mediation with a touch screen tablet

Mothers used tablets to help their children successfully form letter shapes and write words. Maternal print and grapho-phonemic mediation behaviours were found to be at similar

levels when mothers used either a tablet or paper and pencil to write the words JUMP and RABBIT. On average, mothers mediated their children's letter and word writing using similar strategies (writing the word for the child to copy and dictating the letter names for children) regardless of the type of writing tool. Mothers were also flexible and adjusted their scaffolding strategies to support children within their Zone of Proximal Development (Vygotsky, 1978), and encouraging their child to complete a task that they would be unable to do on their own. Mothers used directional language to guide children's letter shaping with a tablet or paper-pencil tool. One mother guided and extended her child's writing efforts on the tablet by saying "Do you want to show me how you write the b? Do a straight line then do a circle on the bottom...(the child shapes the letter correctly)...Good girl!"

All mother-child interactions were warm and affectionate as shown by the frequency of positive affective feedback. Previous studies have described how parents provide positive feedback and reinforcement such as "you wrote this letter beautifully" to their children during joint writing activities (Aram, 2010). Similarly, the present study showed that mothers used affective feedback (e.g., "I am very proud of you") to encourage their child to complete word writing using either writing tool. Similar to the affective feedback findings, no significant differences were found in the frequency of maternal utterances across tablet and paper-pencil tools. This highlights that mothers in this study were consistent in the quantity of their verbal support and flexible in supporting their children's learning with tablets.

Relations between mediation and emergent literacy

Print mediation during tablet use was positively related to letter name knowledge, letter sound knowledge, letter writing, name writing, but not print concepts. Although correlation does not imply causation it may be possible that joint writing with tablets could provide a positive tool for helping children develop letter shaping skills. Writing on a tablet screen to support print concepts such as directionality requires further examination. Print

mediation in the paper-pencil task where mothers guided children's letter shaping was associated with letter name knowledge, letter sound knowledge, letter writing, name writing, and print concepts. Grapho-phonemic mediation during paper-pencil use where mothers helped children retrieve letter-sound connections and placement of letters in the correct sequence from left to right was related to letter sound knowledge and print concepts. These print and grapho-phonemic mediation findings align with previous joint writing research using traditional writing tools that showed positive relationships between emergent literacy and maternal mediation (Aram & Levin, 2001; Skibbe et al., 2013).

In contrast, when mothers used a tablet, higher levels of graphophonemic mediation was not related to higher letter sound skills. Examination of the frequencies of maternal mediation strategies during joint writing revealed that mothers rarely engaged in instructional strategies such as encouraging their child to retrieve letter sounds and linking them to the letter name when writing. The absence of this level of maternal support may explain why grapho-phonemic mediation did not predict children's emergent literacy skills. This highlights the need to support parents in their use of grapho-phonemic strategies to scaffold children's early writing during tablet use. Encouraging deeper parent mediation strategies that help children segment words into sounds and retrieve the next letter sound may be beneficial.

The frequency of maternal utterances was positively related to both print and grapho-phonemic mediation in the tablet condition. Early literacy skills are substantially supported by the provision of parent-talk and rich language experiences during literacy activities (Hart & Risley, 1995; Landry & Smith, 2001; Otto, 2008). The extent of parent-child talk during early literacy activities is an important factor to consider when using digital tools. It is possible that the additional interactive, technical, and operational features of the tablet provided a context that promoted further discussion and language exchanges between parent and child (e.g., Questions: "What does that do?"; Directions: "Press that button"). Further

research is needed to determine whether joint writing with tablets provides richer language exchanges between parents and children (compared with traditional writing tools) and the impact of this on children's vocabulary development. Finally, similar to Aram (2010), the present study found no relationship between affective feedback and children's emergent literacy skills for the tablet or paper-pencil condition with the exception of print concepts. A more rigorous approach may be needed to tease out potential relationships by using a finer classification of the types of affective feedback mothers provided for specific emergent literacy skills.

Practical implications

The present findings show that mothers can use new mobile technologies such as tablets to successfully guide their children's letter and word writing. Print mediation during tablet use showed positive relations with children's emergent literacy skills. Parents were observed to use directional language ("i goes down with a dot") when helping children form letter shapes. Here is an example of a mother using directional language to help her child form the letter T in RABBIT on the tablet ".....line, and cross, that's a good t, very good job". However, the mother did not help the child retrieve the letter T sound in the word rabbit, only saying the letter's name. Providing parents with additional strategies such as helping children make letter-sound connections during the creation of words may help foster children's emergent literacy learning.

The benefits of coaching mothers in writing mediation are highlighted by Levin and Aram (2012) who found that children's alphabet knowledge improved following parent-child joint writing activities with non-digital tools (e.g., writing words, playing magnetic letter games, emphasising beginning word sounds, and manipulating letters). Given that tablets and early writing apps have rich visual feedback during mark making and letter creation, tablets may have the potential to foster letter shaping abilities (Price, Jewitt, & Crescenzi, 2015).

Future research is needed to examine how tablets can be integrated into a home literacy program to foster emergent writing skills in young children.

Neumann's (2016) recent study ($N = 57$, 2 - 4 years old) found a positive relationship between the frequency of writing with tablets at home and print concepts and letter sound knowledge. This indicates potential benefits in using tablets to support parent-child writing experiences and emergent literacy skills. Home literacy programs that also encourage parent joint writing interactions to foster typing using a tablets' pop-up keyboard could better prepare children for digital literacy learning at school. As letters are easily seen on a pop-up keyboard, children's focus could be directed towards grapho-phonemic concepts rather than using physical and cognitive resources to shape each letter. This may be important to consider if a child is young or their pencil holding skills are still developing. To ensure a broad range of early writing experiences it is recommended that a balanced approach be adopted in the use of writing tools. Young children need experiences with a range of non-digital traditional tools (e.g., playdoh, sand, paint, pencils, crayons, markers) to complement joint writing experiences with tablets.

Limitations and future research

The correlational nature of the present study precludes any causation of the findings. Randomised controlled studies are needed to rigorously determine the effects of parent-child use of tablets to support emergent writing and literacy development. The findings cannot be generalised to the greater population due to the small sample size of mothers and children of middle SES background from the same community. Emergent literacy assessments should be also conducted using tablets to more validly represent children's knowledge of digital print concepts, letter writing ability, and letter identification (Neumann et al., in press).

To minimise the potential effects of the order of tasks, a reverse order design of tablet and paper-pencil task should be applied in future comparison joint writing studies. However,

as the primary purpose of the present study was to examine mother-child joint writing using a tablet, the tablet task was completed first to eliminate any chance of effect of the paper-pencil activity on the tablet activity. In addition, the results of the paper-pencil task were similar to the findings of previous studies (Aram & Levin, 2001; Skibbe et al., 2013). This suggests a minimal chance that the paper-pencil task was influenced by the tablet task. Future studies could also examine the simultaneous use of both digital and traditional tools to support early writing since both types of tools are used in homes and preschool settings.

The controlled nature of the present writing tasks completed in a child care centre may reduce the ecological validity of the findings. However, using a set writing task allowed some standardisation over the writing activity which assisted with the examination of relationships with other variables and behaviours across tasks. **As the results do not provide direct insights into the types of joint writing interactions with tablets that would naturally occur in homes, further research is needed to determine how families utilise mobile devices to scaffold young children's emergent writing and literacy learning.**

Conclusion

The present study shows that new technologies such as touch screen tablets can engage young children by providing stimulating and interactive writing experiences. These positive digital parent-child experiences have the potential to foster emergent writing skills. Mothers provided similar mediation strategies and frequency of utterances and affective feedback when using either a tablet or paper and pencil. However, grapho-phonemic mediation during tablet use was not related to emergent literacy skills. This requires the design of evidenced based scaffolding strategies to effectively support parent-child joint writing with tablets at home.

References

- Aram, D. (2002). Joint writing in Hebrew of dictated words versus proper names: Analysis of low SES mother-kindergartner dyads. *Journal of Research in Childhood Education*, 17, 47-61.
- Aram, D. (2007). Sensitivity and consistency of maternal writing mediation to twin kindergartners. *Early Education and Development*, 18, 71-92.
- Aram, D. (2010). Writing with young children: A comparison of paternal and maternal guidance. *Journal of Research in Reading*, 33, 4-19.
- Aram, D., & Bar-Am, O. C. (in press). Mothers helping their preschool children to spell words: A comparison between interactions using the computer vs. pencil and paper. *International Journal of Child-Computer Interactions*, 2016, <http://dx.doi.org/10.1016/j.ijcci.2016.03.001>
- Aram, D., & Bar-Am, O. C. (2015). Parent-child early writing interactions: Parental support when using a keyboard and a pencil. In K. Alvarez (Ed.), *Parent-child interactions and relationships: Perceptions, practices, and developmental outcomes* (pp. 163-179). Hauppauge, NY: Nova Science Publishers Inc.
- Aram, D., & Levin, I. (2001). Mother-child joint writing in low SES sociocultural factors, maternal mediation, and emergent literacy. *Cognitive Development*, 16, 831-852.
- Aram, D., & Levin, I. (2002). Mother-child joint writing and storybook reading: Relations with literacy among low SES kindergartners. *Merrill-Palmer Quarterly*, 48, 202-224.
- Aram, D., & Levin, I. (2004). The role of maternal mediation of writing to kindergartners in promoting literacy in school: A longitudinal perspective. *Reading and Writing: An Interdisciplinary Journal*, 17, 387-409.

- Aram, D., Most, T., & Mayafit, H. (2006). Contributions of mother-child storybook telling and joint writing to literacy development in kindergarteners with hearing loss. *Language, Speech, and Hearing Services in Schools, 37*, 209-223.
- Baghban, M. (1984). *Our daughter learns to read and write: A case study from birth to three*. International Reading Association: Newark Delaware.
- Baghban, M. (2007). Scribbles, labels, and stories: The role of drawing in the development of writing. *Young Children, 62*, 20-26.
- Bodrova, E., & D. J. Leong. (1998). Scaffolding emergent writing in the Zone of Proximal Development. *Literacy Teaching and Learning, 3*, 1-18.
- Beschorner, B., & Hutchison, A. (2013). iPads as a literacy teaching tool in early childhood. *International Journal of Education in Mathematics, Science and Technology, 1*, 16-24.
- Bigelow, E. C. (2013). *iWrite: Digital message making practices of young children*. PhD Thesis, Vanderbilt University, USA. Retrieved from Proquest 3575558.
<http://gradworks.umi.com/35/75/3575558.html>
- Bloodgood, J. W. (1999). What's in a name? Children's name writing and literacy acquisition. *Reading Research Quarterly, 34*, 342-367.
- Burns, M.S., & Casbergue, R. (1992). Parent-child interaction in a letter-writing context. *Journal of Reading Behavior, 24*, 289-312.
- Byte By Byte LLC. (2014). Draw buddy app. <https://itunes.apple.com/us/app/draw-buddy/id560543032?mt=8>
- Clay, M.M. (1975). *What did I write?* Portsmouth, NH: Heinemann Educational Books.
- Clay, M. M. (2005). *An observation survey of early literacy development*. Auckland, N.Z: Heinemann.
- Clay, M. M. (2009). *Follow Me Moon*. Rosedale, Northshore: Pearson.

- Crescenzi, L., Jewitt, C., & Price, S. (2014). The role of touch in preschool children's learning using iPad versus paper interaction. *Australian Journal of Language and Literacy*, 37, 87-95.
- Crystal, D. (2008). *A Dictionary of Linguistics and Phonetics*. 6th Edition. Malden, MA: Blackwell Publishing.
- DeBaryshe, B. D., Buell, M. J., & Binder, J. C. (1996). What a parent brings to the table: Young children writing with and without parental assistance. *Journal of Literacy Research*, 28, 71-90.
- Diamond, K. E., Gerde, H. K., & Powell, D. R. (2008). Development in early literacy skills during the pre-kindergarten year in Head Start: Relations between growth in children's writing and understanding of letters. *Early Childhood Research Quarterly*, 23, 467-478.
- Gerde, H. K., Bingham, G. E., & Pendergast, M. L. (2015). Reliability and validity of the Writing Resources and Interactions in Teaching Environments (WRITE) for preschool classrooms. *Early Childhood Research Quarterly*, 31, 34-46.
- Hall, A. H., Simpson, A., Guo, Y., & Wang, S. (2015). Examining the effects of preschool writing instruction on emergent literacy skills: A systematic review of the literature. *Literacy Research and Instruction*, 54, 115-134.
- Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experiences of young American children*. Baltimore, MD: Brookes.
- Hollingshead, A. B. (1975). *The four-factor index of social status*. New Haven, CT: Unpublished manuscript. Yale University.
- Landry, S. H., & Smith, K. E. (2001). *The influence of parenting on emergent literacy skills*. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of early literacy research: Vol. 2*. (pp. 135-148). New York, NY: Guildford Press.

- Levin, I. & Aram, D. (2012). Mother–child joint writing and storybook reading and their effects on kindergartners’ literacy: An intervention study. *Reading and Writing: An Interdisciplinary Journal*, 25, 217-249. doi:10.1007/s11145-010-9254-y
- Levin, I., & Bus, A. G. (2003). How is emergent writing based on drawing? Analyses of children’s products and their sorting by children and mothers. *Developmental Psychology*, 39, 891-905.
- Livingstone, S., Marsh, J., Plowman, L., Ottovordemgentschenfelde, S., & Fletcher-Watson B. (2014). *Young children (0-8) and digital technology: A qualitative exploratory study national report - UK*. Joint Research Centre, European Commission, Luxembourg. <http://eprints.lse.ac.uk/60799/>
- Marsh, J., Yamada-Rice, D., Bishop, J., Lahmar, J., Scott, F., Plowman, L., Piras, M., French, K., Robinson, P., Davis, S., Davenport, A., Winter, P. (2015). *Exploring Play and Creativity in Pre-Schoolers’ Use of Apps: Technology and Play*. Economic and Social Research Council. <http://www.techandplay.org/tap-media-pack.pdf>
- Mayer, K. (2007). Emerging knowledge about emerging writing. *Young Children*, 62, 34-40.
- Merchant, G. (2015). Keep taking the tablets: iPads, story apps and early literacy. *Australian Journal of Language and Literacy*, 38, 3-11.
- Neumann, M. M. (2014). An examination of touch screen tablets and emergent literacy in Australian pre-school children. *Australian Journal of Education*, 58, 109-122. doi: 10.1177/0004944114523368.
- Neumann, M. M. (2016). Young children’s use of touch screen tablets for writing and reading at home: Relationships with emergent literacy. *Computers and Education*, 97, 61-68. doi: 10.1016/j.compedu.2016.02.013.

- Neumann, M. M., Finger, G., & Neumann, D. L. (2017). A conceptual framework for emergent digital literacy. *Early Childhood Education Journal*, 45, 471-479. doi: 10.1007/s10643-016-0792-z.
- Neumann, M. M., Hood, M., & Ford, R. (2012). Mother-child joint writing in an environmental print setting: Relations with emergent literacy. *Early Child Development and Care*, 182, 1349-1369.
- Neumann, M. M., & Neumann, D. L. (2010). Parental strategies to scaffold emergent writing skills in the pre-school child within the home environment. *Early Years: An International Journal of Research and Development*, 30, 79-94.
- Neumann, M. M. & Neumann D. L. (2015). The use of touch screen tablets at home and pre-school to foster emergent literacy. *Journal of Early Childhood Literacy*, 17, 203-220. doi:10.1177/1468798415619773.
- Neumann, M. M. & Neumann D. L. (2016). An analysis of mother-child interactions during an iPad activity. In K. Alvarez (Ed.), *Parent-child interactions and relationships: Perceptions, practices, and developmental outcomes* (pp. 133-148). Hauppauge, NY: Nova Science Publishers Inc.
- Nevski, E., & Siibak, A. (in press). The role of parents and parental mediation on 0-3-year olds' digital play with smart devices: Estonian parents' attitudes and practices. *Early Years*, 2016 doi: 10.1080/09575146.2016.1161601.
- Ninio, A., & Bruner, J. (1978). The achievement and antecedents of labelling. *Journal of Child Language*, 5, 1-15.
- Ofcom. (2014). *Children and Parents: Media Use and Attitudes Report*. London: Office of Communications. http://stakeholders.ofcom.org.uk/binaries/research/media-literacy/media-use-attitudes-14/Childrens_2014_Report.pdf
- Otto, B. (2008). *Literacy development in early childhood: Reflective teaching for birth to age*

- eight*. Upper Saddle River, NJ : Pearson Education.
- Price, S., Jewitt, C., & Crescenzi, L. (2015). The role of iPads in pre-school children's mark making development. *Computers & Education*, 87, 131-141.
- Puranik, C. S., & Lonigan, C. J. (2011). From scribbles to scrabble: Preschool children's developing knowledge of written language. *Reading and Writing Reading: An Interdisciplinary Journal*, 24, 567-589.
- Rideout, V. (2011). *Zero to eight: Children's media use in America*. San Francisco, CA: Common Sense Media.
- www.commonsensemedia.org/sites/default/files/research/zerotoeightfinal2011.pdf
- Schickedanz, J. A., & Casbergue, R. M. (2009). *Writing in preschool: Learning to orchestrate meaning and marks*. Newark, DE: International Reading Association.
- Skibbe, L. E., Bindman, S. W., Hindman, A. H., Aram, D., Morrison, F. J. (2013). Longitudinal relations between parental writing support and preschoolers' language and literacy skills. *Reading Research Quarterly*, 48, 387-401.
- Tolchinsky, L. (2003). *The cradle of culture and what children know about writing and numbers before being taught*. Mahwah, NJ: Lawrence Erlbaum.
- Vygotsky, L.S. 1978. *Mind and society: The development of higher mental processes*. Cambridge: Harvard University Press.
- Wood, D., Bruner, J. C., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, 17, 89-100.
- Wood, E., Petkovski, M., De Pasquale, D., Gottardo, A., Evans, M. A., & Savage, R. S. (2016). Parent scaffolding of young children when engaged with mobile technology *Frontiers in Psychology*, http://www.frontiersin.org/Journal/Abstract.aspx?s=305&name=developmental_psychology&ART doi:10.3389/fpsyg.2016.00690

- Wollscheid, S., Sjaastad, J., Tømte, C., & Løver, N. (2016). The effect of pen and paper or tablet computer on early writing – A pilot study. *Computers & Education*, 98, 70-80
- Wollscheid, S., Sjaastad, J., & Tømte, C. (2016). The impact of digital devices vs. Pen(cil) and paper on primary school students' writing skills – A research review. *Computers & Education*, 95, 19-35.
- Yamagata, K. (2007). Differential emergence of representational systems: Drawings, letters and numerals. *Cognitive Development*, 22, 244-57.
- Yost, N. (2003). Computers, kids, and crayons: A comparative study of emergent writing behaviours. Australian Computer Society, Inc. IFIP Working Group 3.5 Conference: Young Children and Learning Technologies, UWS, Paramatta, July, 2003.