

# iPlay, iLearn, iGrow



**Nicola Yelland**, Professor of Education, Victoria University, Melbourne  
**Caja Gilbert**, Research Officer, Victoria University, Melbourne

Research undertaken for IBM

## CONTENTS

Executive Summary.....	1
Background.....	2
Research Design.....	6
The Contexts.....	6
Findings	
2-3 Year Olds (Mother’s Group).....	8
4 Year Olds (Kindergarten).....	10
5-6 Year Olds (Preparatory Class).....	14
Conclusions.....	17
References.....	18
Appendices	
Appendix 1: Apps used by 2-3 Year Olds.....	20
Appendix 2: Apps used by 4 Year Olds.....	21
Appendix 3: Apps used by 5-6 Year Olds.....	22
Appendix 4: Video Vignettes.....	23

### **Professor Nicola Yelland**

College of Education  
Victoria University  
Footscray Park Campus  
Ballarat Road  
Mebourne  
Victoria, 3051  
Australia.

Contact: [nicola.yelland@vu.edu.au](mailto:nicola.yelland@vu.edu.au)

We would like to thank all the children, teachers, mothers, grandmothers, principals and DEECD personnel who made this research possible.



MELBOURNE AUSTRALIA



## EXECUTIVE SUMMARY

This report presents the findings from a project that used tablet technology with young children (aged 2 to 6 years of age) in three different early childhood settings. The project was designed to explore the possibilities for learning in each setting to determine if the use of tablets is appropriate for this age group.

The project builds on the successful IBM *KidSmart Early Learning Program* by exploring the potential of tablet technologies for knowledge building, meaning making and learning. Reconceptualising *KidSmart* requires going beyond using new tablet technologies as playthings like blocks, puzzles or construction toys. Educators need to be aware of the wider range of uses of tablets to enable learners to become creators, innovators and to support them in their reflections about the things around them. This project was designed to investigate this potential but in the first instance it was essential to:

1. Describe what constitutes **effective pedagogies** when using tablet technologies in early childhood settings
2. Examine the potential of **new applications** to support the teaching and learning of literacy and numeracy with young children
3. Explore the ways in which tablet technologies can be **incorporated and integrated into early childhood curricula** to support new forms of meaning making, knowledge building and learning in the early childhood years.
4. Work with teachers to explore **professional learning opportunities** that will enable teachers to effectively incorporate tablet technologies into their programs.

The main **findings** by age group were:

- a. **2 - 3 year olds (Mother's group):** The tablets created learning contexts that encouraged interactions and collaborations between children, opportunities for them to converse with adults to increase their language and vocabulary skills, and to build the foundation skills (e.g. sorting, matching, classifying).
- b. **4 year olds (Kindergarten):** The tablet play was a stimulus for conversations, a source of collaborations and a location for social encounters. The tablets were successfully integrated into a play-based program, providing opportunities for choice and self-regulation of activities. There was a glimpse of the potential of the tablets to be a resource for reflection, investigations and documentation of lived experiences.
- c. **5/6 year olds in a (Preparatory class):** The tablets' use supported basic skills for learning and advanced language skills for children who were being inducted into school ways of 'doing' and 'being'. Individual and small group learning was experienced with a detailed focus on conceptual understanding (building number skills, recognition of letters and sounds, word knowledge), using language in context (eBooks) and as a stimulus for talking in English (often a second language).

## Recommendations

1. Tablet technologies should be incorporated into play based early childhood learning contexts since they represent an exciting and viable resource for young children from aged 2 to 6 years to support explorations and learning.
2. The pedagogical repertoires of teachers and carers need to be extended so that they are able to incorporate the potential of new tablet technologies into early learning experiences.
3. The use of tablets should go beyond a narrow focus on concept and skill building to incorporate opportunities for playful explorations, reflections and investigations.
4. The provision of Professional Development and resources about research based activities incorporating tablet technology would assist teachers to promote engagement with ideas and deep learning.

## BACKGROUND

In the past 20 years we have witnessed dramatic changes in societies, economies and our everyday lived experiences as a result of the ubiquitous presence of new technologies (Yelland, 2007, 2010). Our personal lives have been transformed with the Internet, social media, and other new forms of communications and devices that enable us to stay connected to our families and friends in diverse locations. Access to information and people is ubiquitous, easy and available to all those who are fluent in the use of new technologies.

**young children are “immersed in practices related to popular culture, media and new technologies from birth”.**

The impact is also apparent in the lives of young children. Marsh, Brooks, Hughes, Ritchie, Roberts and Wright (Marsh et al., 2005) stated that young children (aged from birth to 6 years of age) are “immersed in practices related to popular culture, media and new technologies from birth” (p.5). This enables them to become adept in operating machines and simultaneously develop a huge array of skills, knowledge and understandings about the world in which they live. Participating in media cultures has affected the ways in which children engage with others and impacts on what they can do, think and feel. Marsh et al. (2005) reported that parents felt that their children, while enjoying new media, still maintained ‘balanced’ lives in which they also participated in activities that did not involve the use of new technologies. In fact, the parents were very positive about the role of new technologies in their children’s lives and thought that they were important to all aspects of their learning. However, Marsh et al. (2005) found that while early childhood practitioners were generally positive about new media, they did express concern about the perceived total amounts of time that children spend on these activities. This is interesting, as there seems to be no data to support the notion that time spent with new technologies detracts from engaging in ‘traditional’ play activities. The practitioners who participated in Marsh et al. (2005) study also indicated that they wanted more professional learning opportunities to assist them to know more about how to incorporate new technologies into their planning. They had noted that when technology was used in their settings the children were more engaged and that they made good progress in speaking, listening and literacy.

Moreover, we know that children are not passive consumers of media. They self-select media content (e.g. favorite TV shows, DVDs and music) and mostly initiate the activities (Rideout et al. 2010). They are truly new millennial kids and live in a multimodal world where the impact of new technologies is significant and ubiquitous (Yelland, 2007; 2010).

Most of the research to date about young children and new technologies has been done in settings with computers and to a lesser extent with other devices such as whiteboards and digital cameras. Research about the use of tablet technologies in education is relatively new. The introduction of the Apple

iPad occurred in April 2010. Prior to this, touch technology really came into being with the introduction of the iPhone and iPod touch in 2007. These devices and their associated applications (Apps) made playing with technologies mobile, and created a new phenomenon called ‘the pass back effect’ (Chiong & Schuler, 2010) defined as when a parent or adult passes their own mobile device to a child, usually for entertainment, for short (15 minute) sessions.

Of the studies conducted with, and about young children and tablets, most are related to the use of iPods, iPod touch and iPads. While many of these describe practitioner based ‘pockets of innovation’ (e.g. Clayton-Brown, 2012; DEECD, 2010; Mullholland, 2011) they tend to be professional commentaries or usability studies on the impact of the new technologies in school or in relation to how they have changed the lives of contemporary young children (e.g. Gliksmann, 2011; Worthen, 2012). There are very few empirical investigations about the impact of touch technologies for teaching and learning, either in preschool or in school contexts. Rather, they advocate ‘tips’ for successful use of iPads (e.g. DEECD, 2011) based on their observations and implementations as teachers or consultants.

The majority of studies conducted since 2008 have been commissioned reports that acted as preliminary investigations of the potential of the technology in formal learning environments. For example, in the US, The *Joan Ganz Cooney Centre* at the *Sesame Workshop* have sponsored investigations regarding the classification of Apps (Schuler, 2012), conducted studies of young children’s learning with Apps (Chiong & Shuler, 2010), and initiated a blueprint for teaching young children in the digital age (Barron, Clayton-Hodges, Bofferding, Copple, Darling-Hammond & Levine, 2011). Also in the US, the Department of Education funded a study of young children, iPads and their Apps as part of their *Ready to Learn Program* (Cohen, 2011). These studies have mainly considered classifying Apps so that a more comprehensive consideration of their learning potential could be realized.

In Australia, Education Departments such as those in Victoria (e.g. DEECD, 2010) and New South Wales (e.g. DEC, 2012) have been involved in iPad ‘trials’ and have described implementations in which children in the compulsory years of schooling have been using iPads as part of their daily activities. As yet, the results of systematic empirical studies with iPads are not available. It is apparent that early childhood teachers regard the technology as useful (Olney, Herrington & Verenikina, 2008) because they enable young children to engage with digital content, but there still seems to be a general reluctance to dismiss new technologies as not being an integral part of early childhood curricula and pedagogical repertoires.

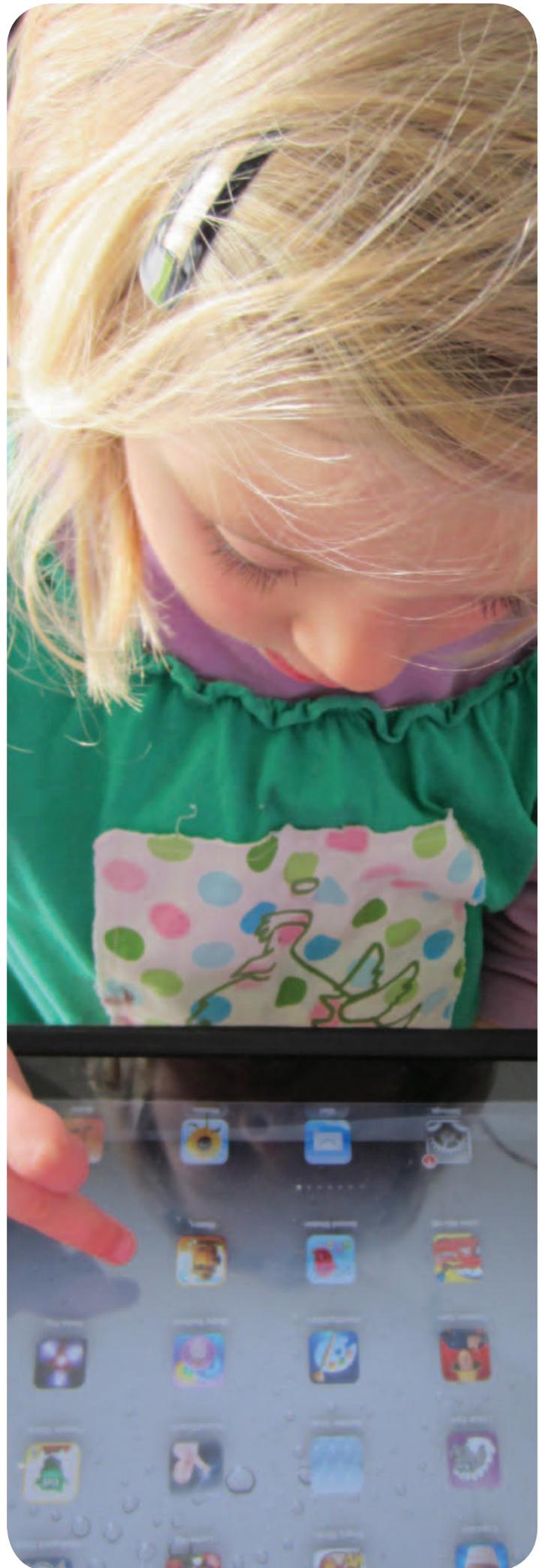
## KidSmart

This project builds on the successful IBM *KidSmart Early Learning Program* (IBM, 2000) by exploring the potential of new technologies for knowledge building, meaning making and learning for young children. Devices such as tablets are now a ubiquitous part of our 21st century lives. The *Young Explorer* computer and software was successful in capturing the imagination of children in disadvantaged preschool settings and enabling them to play with technologies as part of an integrated early childhood program. An integral part of the project design was to support teachers with professional learning opportunities that enabled them to effectively understand and integrate computers into their curricula as well as to participate in seminars and action research projects that extended their professional opportunities.

The evaluation data (IBM, 2000) indicated specific areas that would benefit from systematic research. These included the:

1. Clarification of **effective pedagogy** in relation to teaching and learning with ICT in early childhood settings
2. Investigation of how **technological literacy or the foundations of multiliteracies** can best be facilitated in early childhood settings
3. Understanding of the impact of **multimedia software** on children whose first language was other than English
4. Assessment of the **impact of multimedia software** on children with disabilities
5. Clear articulation of the opportunities that ICT presents for **new ways of learning**
6. Development of **teachers' and parents' understandings** in relation to ICT use with young children
7. Exploration of the **impact of early access to ICT** on children's first years at school
8. Examination of the impact of developing use of ICT in preschool settings through **peer tutoring**

Yelland (1999, 2007, 2010) has suggested that an effective pedagogy utilising new technologies can be encapsulated in the notion of *playful explorations*. In playful explorations, not only are new technologies part of a repertoire of experiences for young children's learning but also, the teacher is to scaffold this learning so that it is articulated and represented by the children in a variety of modes. In this way, playful explorations provide evidence of children's multimodal learning and encourage the use of a variety of media and resources that are part of this learning as well as being artefacts of the learning process. This requires a rethinking of the literacy that is required as a basic skill to a new conceptualization of multiliteracies that are fundamental to social and personal futures for all citizens.



## The Apps

*iTunes* has become the main repository for purchasing Apps for tablet users. A study by Shuler (2009) found that of all the 100 top selling Apps in iTunes, which at the time were only available for use on the iPhone and iPod, 47% were classified as being appropriate for preschool and elementary (primary) aged children. Watlington (2011) studied the free Apps that were designated as being designed for young children in iTunes (108 Apps). She applied the criteria from the 1998 *Haughland Developmental Scale* (Haughland, 1990) that were based on the principles of Developmentally Appropriate Practice (DAP) and concluded that only 48% of the Apps were 'developmentally appropriate' based on this analysis.

Goodwin & Highfield (2012) conducted a systematic analysis of the 'top 10 education Apps' (n = 240) on four different occasions over a period of 6 months in 2011. They classified the Apps on the basis of their pedagogical design features in three categories; *instructional, manipulable and constructive*. They considered instructional Apps as primarily being drill and practice activities that had no opportunity for deviation from the design and required a 'right' answer. Goodwin & Highfield (2012) contended that such Apps have minimal cognitive investment on the part of the learner. Manipulable Apps allowed for guided discovery and experimentation, but they both were limited to the design context. Constructive Apps were more open-ended and allowed users to create their own content or digital artifact. Not surprisingly, 75% of the Apps were classified as being Instructive, 23% were manipulable, while only 2% were constructive. This makes it difficult for the majority of Apps to be used in preschool settings as the predominant form of pedagogy is based on play with minimal direction or instruction. Further, as Goodwin and Highfield (2012) suggested the classification of content as being 'Educational' is somewhat misleading in many instances, since many of the Apps are simply reinforcing basic skills or concepts via repetition. However, it has to be noted that this seems very attractive to both parents and young children in pass-back contexts while in cars, planes or out shopping.

The classification of Apps and a consideration of their content, has led to recommendations regarding their appropriateness based on whether they are 'developmentally appropriate' or not. Cohen (2011) in fact suggested:

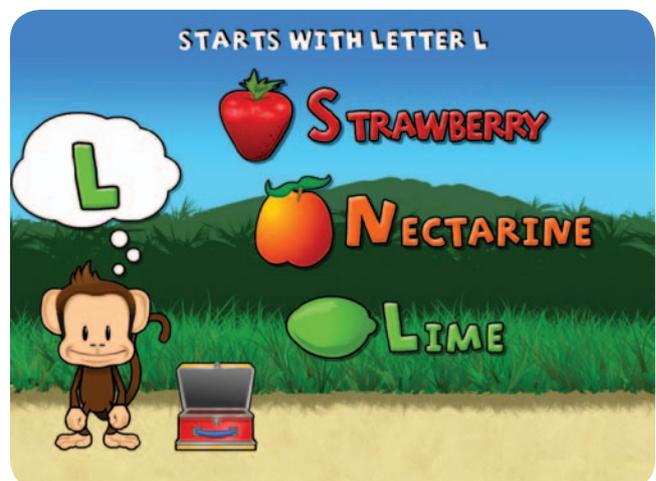
Children as young as two years old access, play and learn with touch screen devices. Children's initial reactions are characterized by fascination and shaped by their developmental level, prior experience with technology, and the design of the App interface and gameplay...iPad access and use are relative to the design of the App interface, game experience and the fit between the App content and the child's developmental level. (p. 2)

Cohen (2011) classified Apps into three groups; *gaming Apps, creating Apps and eBooks*. His study was based on observations and interviews with 60 children in three age groups; 2 - 3 years, 4-5 years and 6 - 8 years of age. The children were observed in classrooms and in a research facility and included a mix of novice and experienced users of tablet technology. Cohen (2001) concluded that children in the study preferred gaming Apps which he said, "...afforded ready access and provided interactive games that are easy to learn and compelling to master". (p. 3) But Cohen also suggested that creating Apps, in particular, had:

High appeal is based on children's interest in making things in a no-fail environment with endless possibilities and outcomes. Additionally, the child's experience is characterized by *learning by doing*, building on their existing skills and being motivated by their own interests. (p. 2)

Cohen contended that there were **three** different types of learning evident during App play. These included:

- *Tacit* learning: of the game and how it works
- *Mastery* of explicit learning tasks (e.g. counting, matching)
- *Learning how to transfer* the use of skills and content learned to *new games or levels* of play



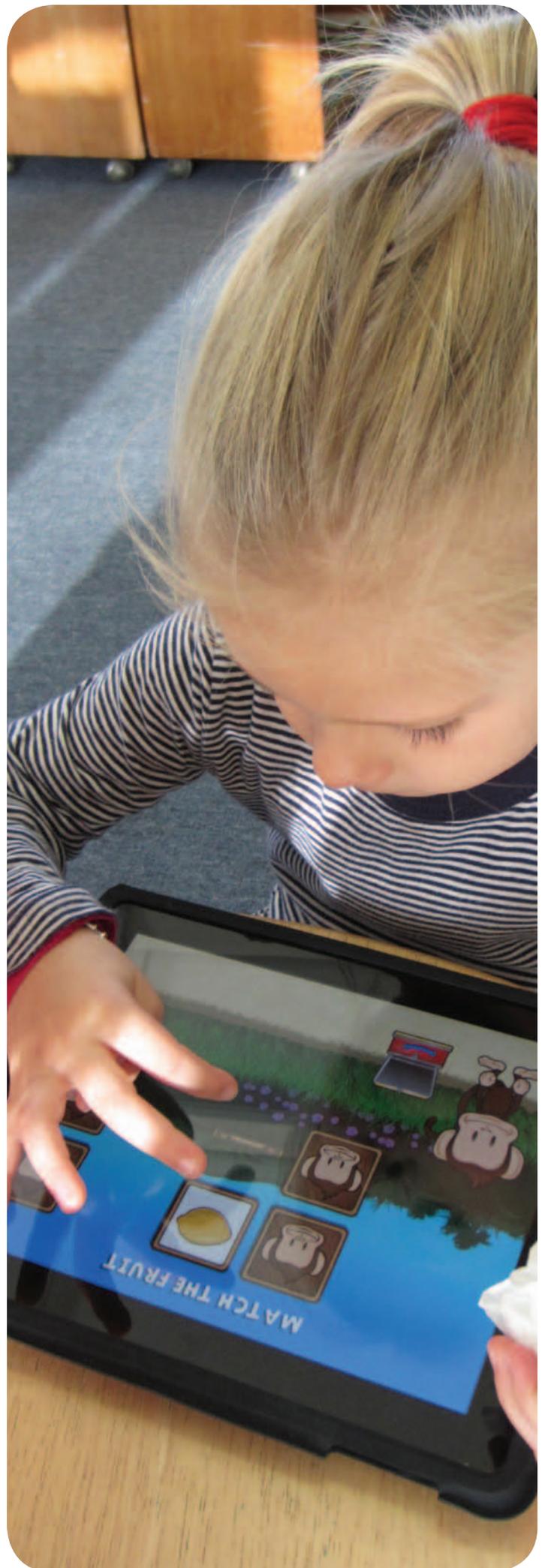
### ***What we know so far....***

Thus, we have a lot of information about Apps and their categorization into various groupings. We also know that young children are very engaged with the Apps and love to play with them for various amounts of time depending on their needs and interests and the content and structure of the App. There are some more detailed observations that have also been made in qualitative studies:

- Young children enjoy playing with iPads (Cohen, 2010; DEC, 2012; DEECD, 2010, 2011).
- Young children explore and learn in ways that are natural to them when using a touch device (Cohen, 2011; DEC 2012; DEECD, 2010).
- Some learning gains related to specific content and skills (reading and vocabulary) have been reported in studies with specific Apps (PBS, 2010).
- The majority of Apps are classified as being 'drill and practice' and characterized by limited choice and specifically controlled outcomes (Goodwin & Highfield, 2011; Shuler, 2012).
- The Apps that allow for more open ended and individual responses would seem to align more successfully with early childhood programs and their approach to learning (Cohen, 2010).
- There is *no* research that suggests ways in which teachers and parents might extend learning using Apps as a catalyst for language and extension explorations.
- There is *no* research that considers the modality of learning with touch technologies and how this is different to traditional learning.

### ***What we need more information about...***

- The ways in which tablet technologies can help children to learn via productive play.
- The connections between play and learning in multimodal contexts.
- What are the features of Apps and other uses of tablet technologies that promote learning in young children?
- How to support teachers to use tablets in their programs.





## RESEARCH DESIGN

This study sought to gather information about the ways in which tablet technologies might be supportive of learning in three early childhood settings; a mothers' group (2 & 3 year olds); a (4 year old) kindergarten; and the first year of compulsory schooling (Preparatory year, 5 - 6 year olds). A goal of the project was to explore the ways in which pedagogical actions influenced learning and how the children responded to the tablets as catalysts for their explorations and learning. We were also interested exploring the ways in which the tablets afforded opportunities for multimodal learning (linguistic, visual, spatial oral and aural) in early childhood settings. To this end, we were restricted to using *iPads* as the example of a tablet technology because most of the Apps available for young children are on this platform.

The research involved 95 children (10 in the mothers' group; 20 in kindergarten; 65 in (3 team teaching) Prep classes). As researchers, we wanted to observe and interact with the children and caregivers and teachers, so we adopted a participant observation methodology. Participant observation can be defined as a method in which, 'the researcher is taking part, to some degree, in the activities of the people being observed' (Deacon et al. 1999, p. 251). The aim of participant observation is to gain access to everyday practices, which are difficult to describe or reproduce in group discussion or interview (Mikos cited in Struppert 2011). Through participation in the context, the researcher can achieve a better understanding of the practice, roles and cultural patterns of the participants (Mikos cited in Struppert 2011).

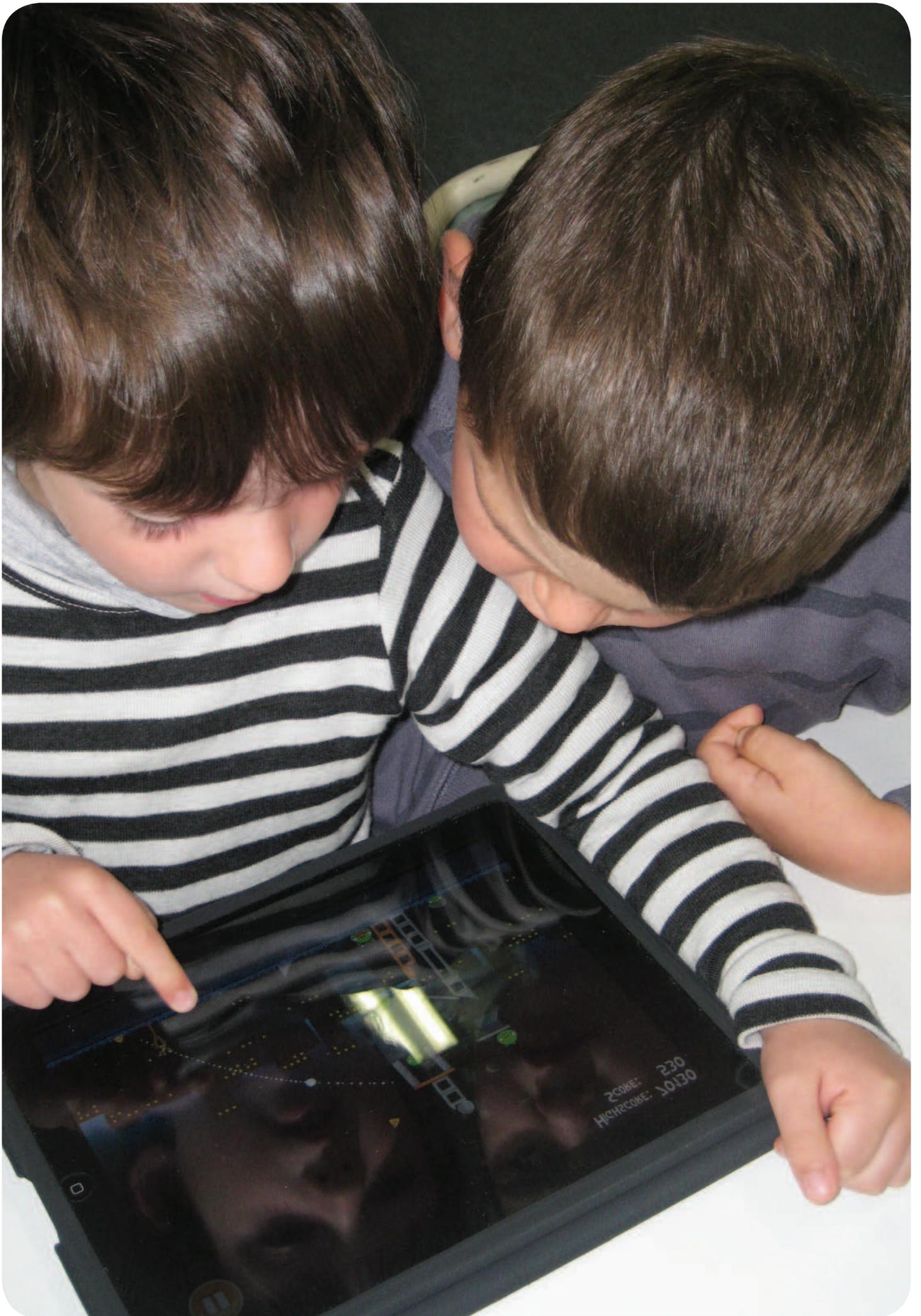
We observed and interacted with the children and adults in each group over a period of 6 weeks, during the course of a school term, for the duration of the session each week. For the mothers' group this was 2 hours, for the kindergarten and school it was half a day. In the mothers' group and kindergarten, the tablets were introduced and then incorporated into the program as just another activity available for the children. With the Preparatory class, the teachers indicated that they thought the most effective use would be to focus on particular children who would benefit from targeted teaching and learning experiences in a small group context. We then became participant observers as the children chose to use the tablets and the Apps on them. After the observation period we left two tablets in the kindergarten setting and the prep class had access to a set of 10 school tablets. An additional goal of the project was to ascertain to what extent the tablets would be used when the researchers were not present. At the end of the term we interviewed the teachers and asked for their reflections on the experience.

## THE CONTEXTS

**2 - 3 year olds (Mothers' group):** The mothers' group was convened at a suburban primary school with funds from the government to support community engagement on the site of public schools in disadvantaged areas. A fully qualified teacher ran the program for one session a week in a multipurpose room located in the school, with a shared outdoor area for wet activities that was easily accessible.

**4 year old (Kindergarten group):** The kindergarten was located in a suburban region approximately 15 km from the centre of a large metropolitan city. It had a large outdoor area that facilitated the fluid movement of the children from indoor to outdoor activity. The teacher had 15 years experience as an early childhood educator and was supported by a teacher aide with 5 years experience. There were 20 children in the group.

**5 - 6 year olds (Preparatory Class):** There were 3 prep classes of 20, 22, & 23 children in the school. They had 3 qualified teachers as well as a full time teacher aide. The teachers adopted a team teaching scenario, in which all the children were introduced to new content and activities in a whole group format by one of the teachers. They then separated into class groupings or small needs based groups for follow up activities. The school was located in a low socio-economic income area, and for more than half of the group, English was not their first language.



## FINDINGS

### 2-3 Year Olds (Mothers' Group)

Every week, the tablets were just one of many activities that were provided, both inside and outside the mothers' group playground. The activities were varied weekly and included opportunities for painting, reading, playing with sand and water, craft (e.g. making necklaces, decorating masks), play dough, puzzles, blocks and engaging in many different things to do.

The Apps used with the mother's group are shown in Appendix 1. They ranged in type from electronic books (e.g. *Three Little Pigs*), playing games with characters from books (e.g. *Angelina Ballerina*) making music, to fun activities like making balloon animals, playing with puppets, driving Lego vehicles.

There was no doubt that the children loved the modality of the tablet technology that meant when they touched the screen in a game or activity, they received an immediate response in some mode (e.g. visual, aural or linguistic). Even though the Apps seemed to be somewhat mundane to parents and educators, the observations revealed that the children in this age group seemed to like playing with the majority of them – although, as we expected, they did not play with the Apps for a sustained period of time but rather 'flitted' from one to another and then back again. The Apps used by this group represented opportunities for them to build foundation skills in mathematics, like sorting, matching, classifying and counting, and they provided contexts to play with music, draw, and play with puppets. There were also Apps that required very simple actions (e.g. popping a balloon, pushing a button, driving a Lego car down a road and making a noise) that usually elicited giggles and laughter from the young child.

**Balloon School** - *Numbered balloons appear on the screen and the children are asked to pop the number given.* Trina enjoyed popping the balloons, and pressing all of them... because even when you get the wrong balloon the App makes a noise...

Exploration was possible but often within predetermined constructs that were inbuilt features of the games. The Apps also provided contexts in which the parent and child could interact and talk about the various components of the game being explored, and thus acted as a stimulus for language to be used and practiced. One of the most noticeable features of this age group was their characteristically short attention span and their ability to quickly pick up the physical skills necessary to navigate around the salient features of a game or the tablet. For example, they were able to exit the games via the 'home' button, switch games regularly and turn the tablet on and off.

Typically, children of 2 years of age do not share their play materials and play in parallel to their peers when in groups. The observations revealed that when a child was playing with the tablet there were some occasions when another child would come over to see what was going on, and they would interact, both verbally and non verbally. This was unique to tablet play.

**Play School Art Maker** - *Characters from Play School can be placed on a selected background scene. Children can move the characters and create a story in movie form.* Tom saw Trina playing with this App and decided he wanted to play it with her. After a short introduction on how to use the App by the researcher they each chose a character (Jemima and Big Ted), dropped them into the scene, and the researcher showed them how to make and watch a movie of their characters. They thought it was funny when they made Big Ted look like he was sitting on another character. Tom became tired of this game and moved back onto the other tablet. Trina continued playing with this App and then asked Tom if they could swap tablets. Tom wasn't interested in swapping...

**Farm Flip** - *Memory game using farm animals.* Zara and Lisa tried to play this memory game together. This didn't work very well as the game didn't recognize multiple fingers touching the screen simultaneously. After a few minutes, Lisa moved onto the other tablet and started playing the Jungle matching game. While Lisa was playing she was also keeping her eyes on what Zara was doing on her tablet and would laugh with Zara when her tablet made a funny animal noise.

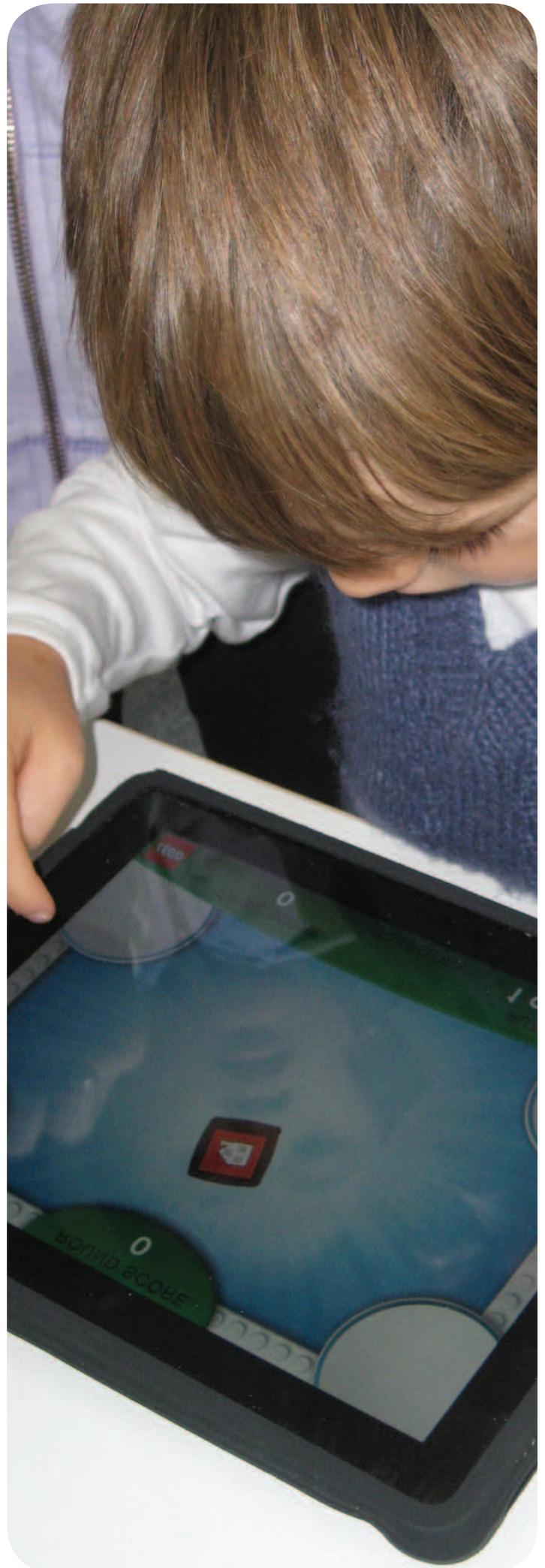
An interesting observation that highlighted the difference between the pedagogical strategies of teachers and parents became apparent in the observations. While teachers typically let children explore and find out things themselves and articulate what they were doing, parents were more likely to direct their child to the right answer, or simply show them how to do something. This was seen when Tom was playing with a puzzle game.

**Underwater scene puzzle:** *Pieces of puzzles are put together to create an underwater scene.* As Tom was trying to do this puzzle, he often tried unsuccessfully to move a puzzle piece into the correct spot. Immediately, his mum showed him the correct placement of the piece, or directed him with specific hints. Tom wasn't ever left to think, even for a minute, so that he could figure out how to do it himself.

In other games, sometimes a child would enjoy getting the 'wrong' answer on an App because of the resultant sound effect. Usually their parent would prompt them towards the correct answer in order to achieve the goal of the game.

Thus, the **main findings** regarding the use of the tablets with 2 – 3 year olds were that:

- *The children responded to the modality (visual, aural, spatial, oral and linguistic) and immediacy of cause and effect of the tablet Apps:* Being able to interact in a dynamic way with linguistic, visual and auditory stimulation enabled the children to experience success in achieving a goal (e.g. making a balloon pop, matching letters to form a word, completing a puzzle that turned into an animated scene) as well as realizing outcomes and the viewing the consequences of their actions.
- *The Apps provided a context in which the children could interact with other children as well as with adults who were with them and thus practice language in action:* For example, as Ben was playing *Super Why!* – he was finding letters and following a path in which the letters made a word. As he was playing his grandmother asked him to identify the letters and say the final words and she also asked him about how many trees he could see in the wood and what color the door of the house was.
- *The activities created contexts for learning foundational skills such as sorting, matching, classifying, recognizing letters and numerals and counting:* for example, when playing with *Lunchbox*, Tom was able to identify the range of fruits that are included in the game as well as sort and count them, identify the odd one out in a sequence, find the first letter of the fruit name, state the color of the fruit, and he also many other opportunities to practice these beginning skills. The games that rewarded players with stickers were favorites of this group, and as this particular game stayed at the same level of difficulty despite repeatedly playing it, Tom collected lots of stickers and was very happy!
- *The Apps enabled children to create, read and listen to stories that were animated as well as having the facility to record their voices and innovate on the text:* For example, when Sophia was playing with *Peppa Pig*, her aunt showed her how to use the self recording option and together they added a new storyline about the visit to the fair by Peppa and her family.
- *The Apps helped the children to make connections between their real world experiences (e.g. blowing up balloons) and allowed them to play with characters they had seen in books (e.g. Angelina Ballerina), on TV (Peppa Pig and Thomas the Tank), or in films (e.g. Cars), thus helping them understand that things exist in different modalities and locations:* For example, when Tina was dressing *Angelina* in her ballet outfit in the App, she said she also had a coloring book with Angelina and she made her dress pink the same to match it.



## FINDINGS

### 4 Year Olds (Kindergarten)

The kindergarten had a play-based program in which the children were able to select an activity from a range of materials that were available, both inside the room and out in the playground. Inside, this included painting materials, a carpet and book area, a puppet theatre and a large range of craft materials and plastic items. Outside there was a sand pit, water play, space to run and various forms of climbing frames. The tablets were available on a table inside, since the children were used to selecting an activity and completing it on a table. As the children became used to having them in the centre they wandered outside to use them. This was a relaxing environment in which to play with the tablets. A list of the Apps used is provided in Appendix 2 and was shared with the parents.

Initially, it seemed as if the boys dominated the use of the tablets, but gradually as the girls saw them having fun with them they joined in and asked for their own turn. In the first two sessions in particular, the tablet was the source of meeting for a group of four boys. They would generally watch each other play a game and then ask for a turn. Many of them had tablets at home and mentioned that they played with specific games like *Cut the rope* and *Where's my water?* These are quite complex games that are enjoyed by adults and children and we had not included them in the repertoire of games available for the 4 year olds. In the first week they made (electronic) cupcakes, played with mice in mazes, explored the puppets of Play School and 'flitted' around playing with various games because they had a puzzle that they liked, or a 'cool' game that helped them to make words from letters (e.g. *Super Why!*, *Number Train*). They also enjoyed Brushes (painting), completing animal puzzles and playing with a range of counting and literacy based word recognition games.

A major difference between these children and those previously described in the mothers' group, who were 2 years younger, was that the 4 year old children shunned direction (by adults) in favor of doing their 'own thing' with the various Apps. They wanted to explore the range of each App's potential, either individually, or with a friend, to figure out what it did, and they often formed groups of two or more to take turns playing the games. The Apps used provided experiences with basic or foundation skills, as well as the use of more complex strategies and skills in games (e.g. *Angry Birds*) and reading and comprehension in electronic book format (e.g. *Teddy's Day*).

All activities in a play-based kindergarten program afford opportunities for children to select what they want to do and interact with others in conversation or in collaborative projects (i.e. build a garage with blocks). Having a tablet as part of this represents another activity in which children are able to play and explore and create a variety of contexts for learning about things, people and ideas. The patterns of play were remarkably similar over the different activities. Some encouraged solitary play (e.g. reading, threading) while others were more creative or open ended (e.g. painting and model making with boxes) or physical (e.g. climbing frames, sand and water play). The tablets could be used both inside and outside

and thus enabled solitary and group play but also provided contexts for the children, and the children with an adult to discuss what they were doing and to make predictions about what might happen next, as well as seeking information on the Internet.

The observations revealed that when using the Apps some patterns emerged:

- *Solitary play* occurred frequently around games that had specific objectives (e.g. completing a puzzle, making a word, counting).

*Observation:* When it was Randall's turn he selected the *Angelina Ballerina App*. In the App, Angelina ballerina thinks of a flower (e.g. A daisy). The player is supposed to use their finger to only pop the bubbles that appear on the screen containing the daisy. The flower that Angelina thinks of changes and the rate of change is controlled by the success of the player. As they improve the bubbles appear at a faster rate.

*Note:* None of the other kids surrounded Randall while he was playing, so he was able to sit and play on his own for approximately half an hour. When the game started Randall began popping all of the bubbles falling from the sky. I told him that for this game he was only meant to pop the bubbles containing the flower that Angelina was thinking about. He immediately understood this direction and began popping only the correct bubbles. After one game he left the App (using the home button) and selected the *Counting Train* (the user has to select the correct number - out of 3 options - to put on the number train). He was able to drag the correct number from the bottom of the screen and place it in the correct position on the number train (e.g. he moved the number 4 in between numbers 3 and 5). He was very pleased when he got the right answer: "I got it right!" he said excitedly and smiled when the App congratulated him. After playing this app for a while (approx. 2 - 3 minutes) he exited by pushing the home button and selected to play *Tally Tots*. In this counting game the player selects a number from 1 to 20 and then counts to that number as well as completing a task such as putting 10 acorns in a squirrel's mouth. He started at the #2 and continued to touch the numbers in order and complete each number task until he reached #10. After he completed a number activity seemed very pleased with his own efforts - exclaiming 'I did it!' excitedly. After completing the activity for #10 he jumped straight to #20 and completed that activity. At the end of the #20 activity fireflies create the #20 and Rory exclaimed - "I made the number"! He then counted down from 20 to 16.

- The tablet activities become *conversation spots* just like other activities:

While some children were playing with the tablet, others watching would chat to me and more would stroll over from another activity station - simply to chat or show me something marvelous that they'd done. For example, Iris made connection from the *Cupcake Maker App* and told me that she cooked with her Mummy on the weekend and made cupcakes, just as Rose was doing with the *Cupcake Maker*; Randall showed me a drawing he had done while Lucy was creating and tablet sketch; Jane showed me a book she was reading and also shared what she was eating for lunch; Rose and Iris told me about the cubby houses that they had created outside. This form of interaction is useful to stimulate connections in the children's minds as well as provide a catalyst for language use and extension.

The 4 year olds were *adventurous and persistent*, they were able to *share usage* of the tablets and demonstrated the capacity to *self-regulate* their use.

Students at the tablet table when Iris started playing: Rose, Randall, Paul, Iris (playing). Venus and Adam were standing and sitting around Iris watching and offering advice on what colors she should choose and what buttons she should push... The timer was timing... Iris playing... but she just gave Rose the tablet soon after she had switched to the *Angry Birds App*, before the timer expired.

Rose had a lot of kids crowded around her while she was playing *Cupcake Maker*. A few were trying to touch the screen, which she didn't like. She said "Don't touch... its my turn!"

Will suggested she should choose green icing: "green, green, green ... [he chanted]. Rose chose light pink. Will says despairingly, "Ohhhhhh I miss green".

Venus advised Rose that the sweets that she was selecting for the top of her cupcake were not healthy: "Lollies not good for you because you get sick". After she said this, Iris started a conversation about how bad lollies are for you and your teeth... When it was time for Rose to hand the tablet over to Randall she did so, but stayed and watched him and joined in a new conversation...

It was also apparent that this group of children were quite *fluent with the foundational skills* that are relevant to the first year of schooling, for example, the positional and relational terms, beginning processes and counting and recognition of numerals. This assisted their playing of many of the Apps that were available on the market.

At the start of this game (*Fireman Sam*) the user is asked to type their name. Venus was able to spell her entire name correctly and select the tick at the bottom of the keyboard when she was finished... She then went on and selected a game in which she had to put out fires in a wood.

When Elaine started playing (*Super Why! Pig Lickety Letter Hunt*) there were no other kids at the table - Venus left after handing the tablet to Elaine. I was sitting to her right and another teacher was sitting to her left. We were chatting as Elaine was playing with the tablet. Elaine told me that she had never played with a tablet before and her family didn't have one at home. She listened to the instructions given by the pig (e.g. "find the letter L"). She would then correctly select the letter "L" out of three letter options. She then exclaimed to me: "I have an L in my name"! Next was the letter A. She correctly selected this as well and again turned again to say: "I have an A in my name too"! Elaine was able to correctly touch the letter, even when the letter wasn't in her name. She wasn't just guessing either. As her hand moved over the wrong letters it was apparent that she was eliminating them as solutions. She was pleased when she got the right answers and stickers. After spelling a few words she exited the App and chose *Moofy's Pattern App*.

One aspect of the study that warrants further investigation is the capacity of the tablet as a resource for *investigation and exploration* by children in kindergarten. We had some examples of the children wanting to find out information, and since the kindergarten had wireless technology it was possible for them to simply pick up the tablet and sit on the sofa or carpet to search on the Internet, with adult assistance. For example, when a group of boys were playing with *Angry Birds*, one of them suggested that they could find more about the game on the Internet as he had done this at home with his parents. We supported their exploration by finding *Google* in the browser, typing the words in the search box, and then we guided their exploration to find a video (*YouTube*) about the range of activities possible in the various extended *Angry Bird* games, as well as in finding a short clip of various angry birds having fun flying in space. The teacher (Naomi) indicated that she was much more interested in the potential of the tablet for exploration and discovery rather than just using it to play with Apps. She envisioned this to include Internet searches for information such as the time when the children expressed an interest in how a butterfly emerges from a cocoon after discovering one in the playground. She realized that there was the potential to use the tablet to record digital photos and movies that could then be either made into books or movies, and subsequently watched by the whole group to stimulate conversations. She advised:

**Naomi's reflective notes:**

*We were keen to use the tablet to access the Internet to research children's interests and ideas, and have done so on several occasions. For example:*

- + Watching a video clip of a volcano eruption in response to the children's interest in volcanoes and following-up with several science experiments conducted in the sandpit.*
- + Watching the metamorphosis process of caterpillar to butterfly following the discovery of a cocoon in the outdoor area.*
- + Researching how to make stop motion animation films and then creating our own.*
- + Identifying various bugs discovered in the outdoor area using the Museum Victoria Field Guide App.*

Naomi also told us of a scenario that took place one day in which having the tablet made a positive difference to the learning of one boy:

**Naomi's reflective notes:**

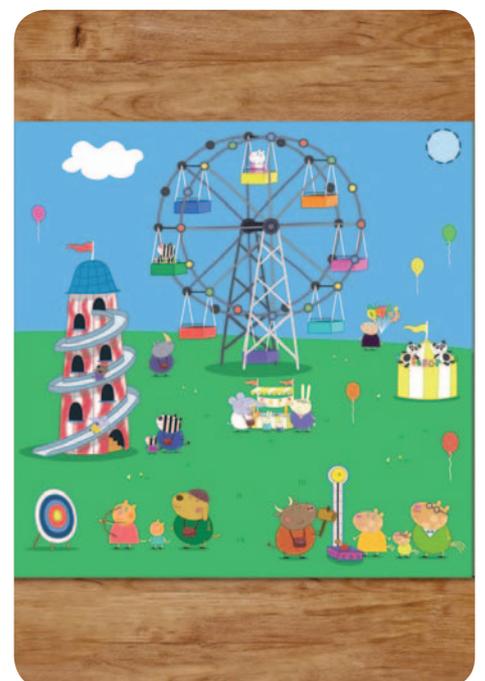
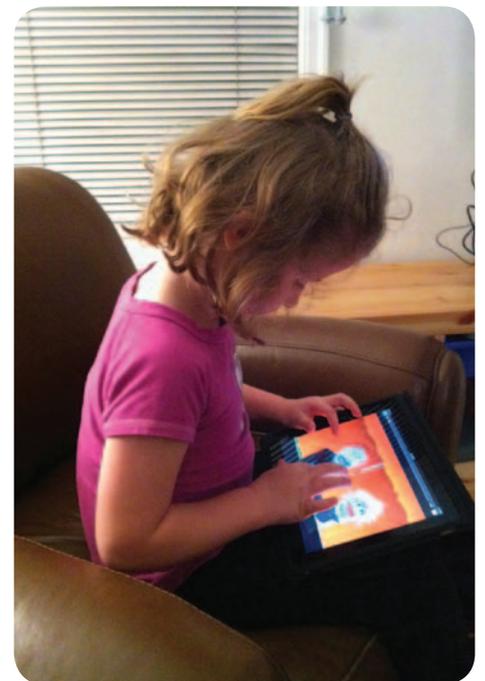
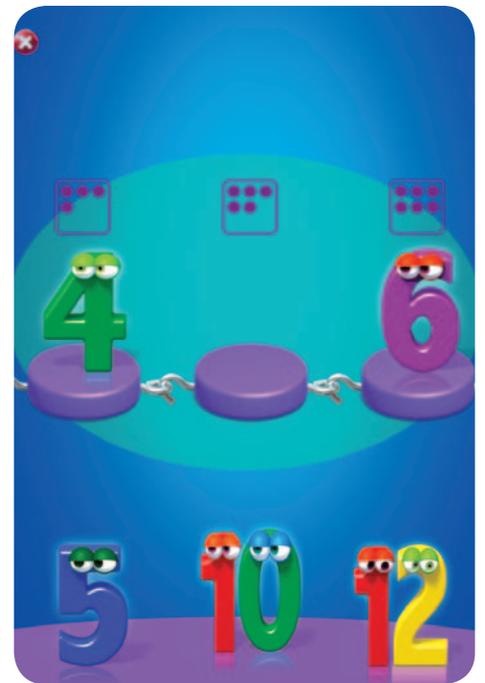
*Owen arrived at kindergarten today with a plan for a project he wanted to complete. "I really want to make a General Grievous costume today," he told me. Unsure as to who General Grievous was, I asked Owen what he looked like. Owen shared that General Grievous was (a character) from the Clone Wars and that "He has four arms which he uses to hold light sabers." I asked Owen if he could draw a picture of General Grievous for me so I could have a better understanding of what he looked like which would then help with the plan to create the costume. Owen didn't want to draw the picture, and continued to describe the character to me. He had very specific instructions about what he wanted it to look like. I then suggested we use the tablet to Google an image of General Grievous to assist us with the creation of the costume. Owen thought this was a great idea, so we did. Owen was pleased to find an image and we set about creating the costume...*

*In this instance the tablet was a valuable resource in supporting Owen to achieve his goal/plan. He arrived at kindergarten eager and enthusiastic and to be able to follow his interest through to completion (which took about 2 hours in total) was very rewarding!*



The **main findings** regarding the use of tablets with the 4 year old kindergarten group can be summarized as follows. Each point is illustrated with (written) reflections by the teacher (Naomi):

1. Using the tablets with the selected Apps provided contexts and opportunities for solitary and social play.  
*The tablets did not isolate children from interacting with their peers, but rather gathered children together. Children were often peer to peer educators, supporting and helping each other to engage with the Apps and navigate their way around the tablets showing each other the volume control, changing screens, going back to home page etc.*
2. One of the major benefits of playing with tablet Apps was the way in which they constituted opportunities for conversations both between children and between adults and children.  
*The tablet connected children through a common interest or focus. When engaged together children enjoyed having conversations about their play. For some children it was a lovely way to build peer interactions.*
3. Activity on the tablets was characterized by self-regulation and persistence.  
*We noticed that when children were engaged with the tablet they displayed intense concentration and focus on the task at hand. Children who often had difficulty sustaining concentration on a specific task, appeared to have no difficulty when engaged with the tablet.*
4. Playing with the Apps provided an opportunity to encounter and use foundational skills for learning.  
*There was lots of exploratory play as children discovered which Apps they liked playing, often revisiting these Apps again in following sessions, consolidating their learning and understanding. This is not dissimilar to children revisiting a theme in imaginative play or building towers with blocks, with each visit they acquire new learning and/or deeper understanding. And...  
I know some parent feedback was that some children's skills had increased since having them here.*
5. Children were able to experience multimodal learning.  
*The tablets provided children with choice as to how they wanted engage in particular learning experiences. A perfect example of this is completing puzzles. Many children enjoyed using the tablet to complete puzzles more so than visiting the 'puzzle table'. Would these children have missed out on developing valuable problem solving and spatial awareness skills if the tablet was not available to engage in these experiences or would they have engaged at the puzzle table anyway if the option to do otherwise was not available? This is one area we would be keen to explore further in future.*
6. There is potential to use the tablets for more reflective, creative and investigative learning with this age group.  
*... I could give the camera to somebody on a day, get them to take photos and then come back and plug it in and everyone could see and they could talk about what is happening. It could be a bit of a reflective journal for the day through a child's eyes - not necessarily mine... if it was the child taking photos and then we sit together and write the journal, its what the child sees as being significant so that would be interesting.*



## FINDINGS

### 5-6 Year Olds (Preparatory Class)

In Victoria, in the first year of compulsory school, 5 year old children enter the Preparatory class. In our research context, three teachers worked as a team, but also had primary responsibility for their own group of children. In this way, most of the major teaching was done to the collective three classes of children (65 children), but then they also worked with their own teacher so that they were able to have more specific instruction and support in the smaller group context. The teachers were a highly cohesive and organized trio and this was a vital component of their success, as the school had students from a large range of different cultures. In fact, in the whole preparatory group there were children of 28 different cultural backgrounds, and many did not have English as their first language. This meant that some of the basic skills of literacy and numeracy were not evident in all the children as they entered school and helping the children to acquire these foundational skills was viewed as being essential to their success at school.

We worked with the teachers to identify the skills that they felt were their priority and sought out Apps which could be used in small group contexts (2 – 4 children) with the children being withdrawn for more focused teaching and learning. A complete list of the Apps used with this group is provided in Appendix 3. The categories they selected were:

1. English as a second language support (ESL)
2. Number Recognition
3. Fine Motor skills
4. Advanced writers
5. Comprehension.

Categories 1 – 3 were identified for support for learning and categories 4 and 5 were for extension of learning. The teachers allocated children from their groups on a needs basis.

#### 1. ESL

Three Apps illustrated the ways in which children can be supported to extend their vocabulary and use English in appropriate ways. These were *Peek-a-Zoo*, *Super Why!* and *Word Wagon*. Firstly, in working with a small group in a focused way, the children were able to listen and follow instructions in English to play with the various components of the games. Each of the Apps used provided learning opportunities to listen to instructions, find words, match words, spell words, and use the words in sentences. They did this in a multimodal context using aural, visual and linguistic stimuli and this enabled the children not only to experience new vocabulary, but to hear it and to see it enacted in visual (moving) scenarios. In this way, the use of the Apps not only engaged the children in learning more effectively with more dynamic sources than static pictures or books, but also enabled them to move through the activities at their own pace and the teacher / researcher could scaffold individuals more effectively in the small group context.

#### 2. Number Recognition

One of skills included as part of the school assessment on entry, relates to the child's ability to count to 20 in sequence,

recognize the numerals and number names, and be able to count a selection of items accurately. As many children in this group were not able to do this, the teachers requested Apps that might teach and reinforce these skills. For example, in *Tally Tots* the children can gain fluency with the numerals to 20. When a number is selected a voice counts to the number. The teacher can count with the child or leave them to work individually. The child is required to count the items in the example – and then completes an activity such as feeding the number of acorns to a squirrel. The child can also see the numeral before and the numeral that follows and select one of them.

Not all of the children in this group were able to demonstrate their understanding of numbers to 20 in the Department of Education screening profile. Yet, in *Tally Tots* they could follow the counting sequence verbally and indicate which numeral matched the spoken number. There were some instances when a child would press 2 for 12, but apart from this they were very accurate.

What was even more evident was their excitement at using the tablets as well as their enthusiasm for completing the tasks successfully. One of the teachers commented the next day on how she noticed that the children's faces "lit up" when they came back from the tablet session.

#### 3. Fine Motor Skills

To help children identified with fine motor problems (which the teachers indicated meant that they were not able to use their pencils effectively to write words or numbers) some Apps were chosen (e.g. *Super Why!*). In this App there are a number of games and one popular one was called *Princess Presto's Wands Up Writing Game*. A fairy would ask the child to spell a word – letter by letter (not phonically). They were then told the sound of the first letter in the word and asked to select the letter that made the sound from a group of four letters. Once they had done this correctly they were shown the letter and arrows directed the way in which this was to be written. The child then traced over the letter with their finger and moved on to the next letter in the word until the letters in the whole word had been traced correctly. Each correct attempt was rewarded with a sticker. This game should have been useful but the American accent, the slowness of the action, the fact that the player only got one chance to hear the sound, the letters were all in capitals, and the action of tracing the letter was clumsy made the game very difficult.

#### 4. Advanced Writers

For young writers the mechanics of writing is often more difficult than the generation of ideas for stories. Consequently, their stories are often restricted by their ability to write. We thought it would be useful to let the children create stories and make a video to express their ideas. The *Play School Art Maker* allows children to create scenes with the characters from play school and then record a one-minute story. In the first session Silas created a moon scene accompanied by the following dialog:

Silas created a scene on the moon using the characters Big Ted, Little Ted, Jemima, 2 x toilet rolls, stars, a planet and an image of the Earth. Following is the audio he recorded while moving the characters on his moon scene around with his finger:

*Big Ted: "I'm a big teddy grrrrrrrr I can fly like superman!"  
(Silas moves Big Ted up into the sky)*

*Little Ted: "I am going to the rocket, I am playing with the football" (Silas moves Little Ted in between the two toilet rolls that he has placed next to each other in his scene. These resemble football goal posts)*

*Jemima: "I am playing with the football too". (Silas moves Jemima in-between the goal posts too).*

Silas was pleased with his video – he laughed as he played it back and heard his voice

## 5. Comprehension

Electronic books (eBooks) tell the story, allow exploration of objects in the story, and now have the capacity to let the reader innovate on the story by entering their own recorded dialog. One of the stories used was called *Teddy's Day*. In this book a little girl is wondering what her Teddy Bear does all day while she is away at school. She poses different possibilities. In working with the groups of children with this eBook, we asked them some questions about the format as we would with a traditional book. For example, 'What is the title?' 'Who is the author?' In sharing the story we also explained how to turn pages and explore what actions the items might produce when clicked.



## Teaching & Learning Scenario – Preparatory Group (RO=Research Officer, H=Helen [child], J=Jill [child])

RO: So we talked about what we think your teddy bears do at home and we're about to find out what this teddy bear does. Helen can you touch the teddy bear for me? (Helen touches the teddy bear) Why don't we touch the alarm clock? (One child touches the alarm clock and the alarm goes off and the teddy wakes up) Wake up teddy! What's he doing now?

J: He's alive.

RO: Helen do you want to touch the teddy's tummy? Or Jill? (J touches the teddy's tummy which is glowing as a prompt to the user to touch it. The teddy jumps on the bed)... And again! (the teddy runs around the bed) What's he doing now?

J&H: Running!

RO: And what did he do before he ran?

H: Jumped!

RO: He did jump on the bed, didn't he?

...

RO: What were they doing in the other room before they were lying on the bed?

H: Playing puzzles and sitting.

RO: They were playing puzzles and sitting. And were the mice there before?

H: Yes.

...

RO: Oh! Who's that?

H: A dolly.

RO: And where have we seen her before?

H: Ummmm ...

RO: What was she doing at the start of the book with the teddy?

H: Dancing with the teddy.

RO: That's right. And is she smaller or bigger than the teddy?

J&H: Smaller.

RO: She *is* smaller isn't she. And is the girl bigger or smaller than the teddy?

H: Bigger than the teddy.

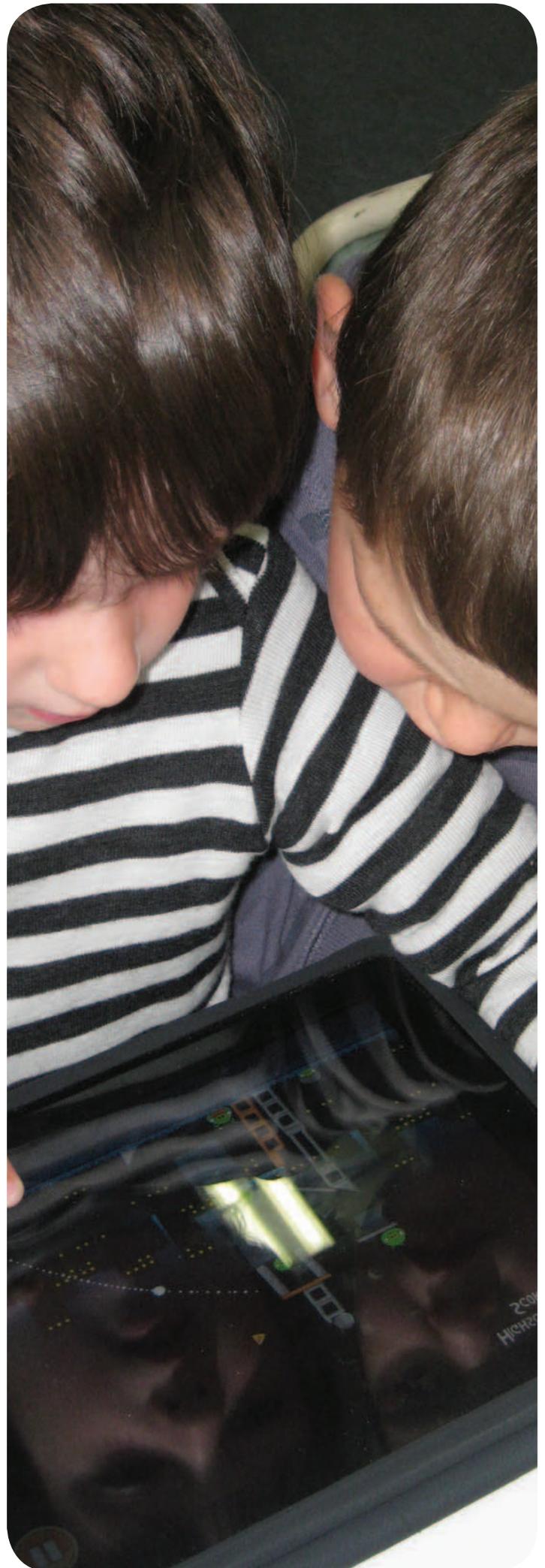
In this way, the book provided the opportunity for a focused lesson on (oral) comprehension of the story and also enabled the children to play with the eBook in a more interactive way than with a traditional book. As we progressed through the term the children were able to navigate their way around the eBooks as they became familiar with the various features inherent to operating the tablet. Again the teachers noted that they knew the children were enjoying using the tablets because they always came back smiling!

### Summary

For the Preparatory class context, the teachers had indicated they wanted to use the tablets both to support and extend the learning of children in a small group context. This both suited their pedagogy and resources available, as the school had a set of 10 tablets. It was relatively easy to select Apps to suit the categories that they outlined as most of the Apps available support literacy and numeracy skill building. Additionally, it was possible to incorporate eBooks here. With eBooks readers are able to have it read to them or read it themselves. Additionally, children are able to explore the items on each page as they progress through; for example, see a door open and close or watch a bird fly out of her nest and return. These Apps complimented the work done in the whole class context.

The use of the tablet with the Apps selected, supported the learning of children who were being inducted into the school ways of 'doing' and 'being' in their first two terms of compulsory schooling. Individual and small group learning with detailed foci on building number skills, recognition of letters and sounds, word knowledge building, using language in context (eBooks) and as a stimulus for conversation was possible. It was possible to incorporate this type of use of the tablets into the Prep class since teacher 'aides' were available to work with small groups. Yet, it requires specific Professional Development to support teachers and aides so that they are aware of what is available and how it might be used with young children.

As with the kindergarten group, there was also the potential to use the tablet for investigations and exploratory play, but the focus of this study was on supporting the establishment of foundational skills and extending reading skills and comprehension. We did however, observe classes in another school that was in the private system in a different state, to illustrate that using the tablet for project work, movie making and as a resource for reflections on learning, was possible with this age group and encouraged them to articulate not only their practical knowledge but also their preferred learning modalities.



## CONCLUSIONS

This study has shown that the use of tablets across three different settings with children aged from 2 to 6 years of age represents a viable learning context in different ways for the children involved.

There was evidence of the following types of learning that had been outlined by Cohen (2011):

1. *Tacit learning* about how the tablet and the various Apps function
2. *Mastery of content*, especially related to basic skills and foundational knowledge in mathematics and English.
3. *The generalization of skills* learnt that could be transferred to a different App

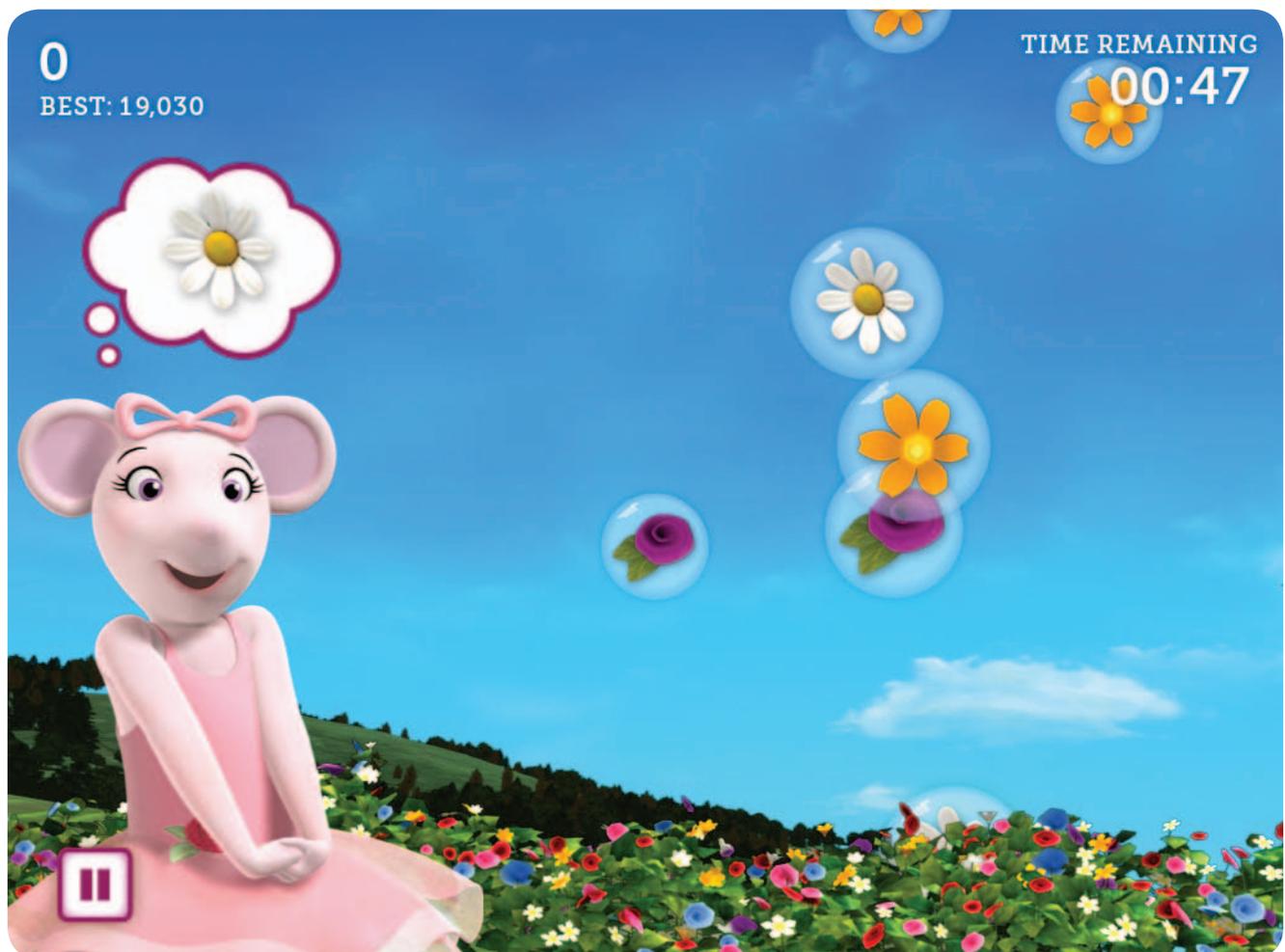
This was apparent in a range of Apps that could generally be categorized as being:

1. *Games* to practice skills (literacy and numeracy)
2. *Creative* – painting and making short movie sequences
3. *eBooks*

While this report has documented the different uses and learning for each of the three groups there were some general trends across the three contexts. These were:

1. *Productive play* was evident in each setting. The children enjoyed the immediacy and the opportunity to experience different *modalities* (aural, oral, visual, spatial and linguistic) in their play.
2. It was possible to document the *learning* of young children in each location and consider the various *pedagogical approaches* that were appropriate
3. The Apps were a source of *social interactions, conversations and provided opportunities for skill build that was translated to new contexts.*
4. *Teachers* should take the time to play and become familiar with Apps to ensure that they suit their goals for learning with their particular age range of children. The claims of the developers are often over inflated and the scope of the App very limited and did not fully use the dynamic features and full potential of the tablet.

Appendix 4 contains video examples of two young children (4 year old Lulu and 3 year old Sophia) playing with some Apps to illustrate the ways in which learning is apparent while engaged in tablet play.



## REFERENCES

- Barron, B., Cayton-Hodges, G., Bofferding, L., Copple, C., Darling-Hammond, L., & Levine, M. H. (2011). *Take a giant step: A blueprint for teaching young children in the digital age*. New York: The Joan Ganz Cooney Center at Sesame Workshop.  
<http://www.joanganzcooneycenter.org/publication/take-a-giant-step-a-blueprint-for-teaching-young-children-in-a-digital-age/>
- Chiong, C., & Shuler, C. (2010). *Learning: Is there an app for that? Investigations of young children's usage and learning with mobile devices and apps*. New York: The Joan Ganz Cooney Center at Sesame Workshop.  
<http://dmlcentral.net/resources/4496>
- Clayton-Brown, K. (2012). *iPads make learning a delight for pupils*. The Southland Times.  
Retrieved from <http://www.stuff.co.nz/southland-times/news/6418994/iPads-make-learning-a-delight-for-pupils>
- Cohen Group. (2007). *Children, families and media: A benchmark*. New York.  
<http://mcgrc.com/publications/publications/>
- Cohen Group. (2011). *Young children, Apps and iPad*. New York.  
<http://mcgrc.com/publications/publications/>
- Deacon, D., Pickering, M., Golding, P., & Murdock, G. (1999). *Research Communications: A Practical Guide to Methods in Media and Cultural Analysis*. New York, NY: Oxford University Press,.
- Department for Education and Communities. (2012). *Use of tablet technology in the classroom*. Sydney, NSW.  
<http://clic.det.nsw.edu.au/clic/tablets.htm>
- Department of Education and Early Childhood Development. (2010). *iPads for learning*.  
Retrieved January 2013., from <http://www.education.vic.gov.au/school/teachers/support/Pages/ipads.aspx>
- Department of Education and Early Childhood Development. (2011). *21 steps to 1 to 1 success*.  
[www.education.vic.gov.au/school/teachers/support/Pages/ipads.aspx](http://www.education.vic.gov.au/school/teachers/support/Pages/ipads.aspx)
- Glikzman, S. (2011). *Assessing the impact of iPads on education one year later*. *Edutechdebate*.  
Retrieved from <https://edutechdebate.org/tablet-computers-in-education/assessing-the-impact-of-ipads-on-education-one-year-later/>
- Goodwin, K., & Highfield, K. (2012). *iTouch and iLearn: an examination of 'educational' Apps*.  
Paper presented at the Early Education and Technology for Children conference.
- Haughland, S. W., & Shade, D. D. (1990). *Developmental evaluations of software for young children*. New York: Delmar.
- IBM Corporation. (2000). *KidSmart Early Learning Program*.  
Retrieved June 6, 2000, from <http://www.ibm.com/ibm/ibmgives/downloads/kidsmart.pdf>
- Marsh, J., Brooks, G., Hughes, J., Ritchie, L., Roberts, S., & Wright, K. (2005). *Digital beginnings: Young children's use of popular culture, media and new technologies*. Sheffield: University of Sheffield.
- Mullholland, J. (2011). *iPads in the classroom*. *Government Technology*.  
Retrieved from <http://www.govtech.com/education/iPads-in-the-classroom.html>
- Olney, I., Herrington, J., & Verenikina, I. (2008, March.) *iPods in early childhood: Mobile technologies and story telling*. In *Hello! Where are you in the landscape of educational technology?*  
Paper presented at the ASCILITE.  
Retrieved from <http://www.ascilite.org.au/conferences/melbourne08/procs/olney.pdf>
- PBS kids. (2010). *There's an App for That*. PBS Kids.  
[pbskids.org/read/files/cooney\\_learning\\_apps.pdf](http://pbskids.org/read/files/cooney_learning_apps.pdf)
- Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). *Generation M2: Media in the lives of 8 to 18 year olds*. Menlo Park, CA.: Kaiser Family Foundation Study.  
<http://www.kff.org/entmedia/mh012010pkg.cfm>

- Shuler, C. (2009).  
*iLearn: A Content Analysis of the iTunes App Store's Education Section*.  
 New York: Joan Ganz Cooney Center at Sesame Workshop.  
<http://www.joanganzcooneycenter.org/publication/ilearn-a-content-analysis-of-the-itunes-app-stores-education-section/>
- Shuler, C. (2012).  
*iLearn II: An analysis of the education category of Apples App store*.  
 New York: The Joan Ganz Cooney Center at the Sesame Workshop.  
<http://www.joanganzcooneycenter.org/publication/ilearn-ii-an-analysis-of-the-education-category-on-apples-app-store/>
- Struppert, A. (2011).  
*Developing Intercultural Awareness and Sensitivity through Digital Game Play*.  
 Macquarie University, East Ryde.
- Watlington, D. (2011, 2011).  
*Using iPod Touch and iPad Educational Apps in the Classroom*.  
 Paper presented at the Proceedings of Society for Information Technology & Teacher Education International Conference.
- Worthen, B. (1012).  
*What happens when toddlers zone out with iPad*. The Wall Street Journal.  
 Retrieved from <http://online.wsj.com/article/SB10001424052702304363104577391813961853988.html>
- Yelland, N. J. (2011).  
 Reconceptualising play and learning in the lives of children.  
*Australasian Journal of Early Childhood*, 36 (2) 4 - 12.
- Yelland, N. J. (2010).  
 New technologies, playful experiences, and multimodal learning. In I. R. Berson & M. J. Berson (Eds.).  
*High tech tots: Childhood in a digital world* (pp. 5 - 22). Charlotte, NC: Information Age.
- Yelland, N. J. (2007).  
*Shift to the future: Rethinking learning with new technologies in education*.  
 New York: Routledge.
- Yelland, N.J. (1999).  
 Technology as Play.  
*Early Childhood Education Journal*, 26(4), 217 - 220.

## Appendix 1: Apps used by 2-3 Year Olds

APP NAME	LITERACY					NUMERACY					CREATIVE					SKILLS	
	Letter Recognition	Phonics	Words	Reading	Sounds	Counting	Sorting/Classify/ign	Matching	Spatial	Draw/Colour	Story Making	Scene Making	Design	Music Making	Fine Motor	Time Limit	
AlphaTots	✓	✓	✓	✓											✓		
Angelina Ballerina Bubble Pop				✓		✓	✓					✓			✓		
Animal Shape Puzzle					✓		✓								✓		
Balloonsimals					✓				✓		✓				✓		
Bananas in Pyjamas: Bubble Time															✓		
City Vehicles					✓												
Farm Flip					✓		✓										
Fireman Sam					✓		✓	✓								✓	
First Words Animals	✓		✓	✓			✓								✓		
KidArt									✓			✓					
Kids Song Machine 2			✓	✓	✓								✓				
Lego Creatory						✓	✓	✓				✓	✓		✓	✓	
Lego App4+							✓					✓					
Monkey Lunchbox	✓		✓			✓	✓	✓									
Monster Chorus					✓		✓							✓			
My Scene						✓	✓	✓		✓	✓				✓		
Playschool Art Maker										✓	✓	✓					
Puzzles N Colouring - Sea Life							✓		✓			✓					
Singing Fingers									✓					✓			
Spot Goes to the Farm			✓	✓			✓										
Super Why!	✓	✓	✓	✓											✓		
Tally Tots						✓	✓										
Teddy's Day	✓		✓	✓	✓				✓								
The Three Little Pigs - Animated Storybook			✓	✓	✓												
Thomas the Tank Engine	✓		✓	✓					✓						✓		

## Appendix 2: Apps used by 4 Year Olds

APP NAME	LITERACY				NUMERACY						CREATIVE				SKILLS	
	Letter Recognition	Phonics	Words	Reading	Counting	Sorting/Classify/ign	Matching	Spatial	Add./Sub	Draw/Colour	Story Making	Scene Making	Design	Music Making	Fine Motor	Time Limit
AlphaTots	✓	✓	✓	✓											✓	
Angelina Ballerina Bubble Pop				✓		✓									✓	
Dress up with Angelina Ballerina		✓				✓							✓		✓	
Angry Birds					✓	✓	✓	✓	✓						✓	
Balloonsimals									✓		✓				✓	
Bananas in Pyjamas: Bubble Time															✓	
City Vehicles			✓													
Counting by fishdog.net					✓											
Cupcake Maker									✓				✓			
Fireman Sam					✓											✓
Futaba	✓		✓													✓
Lego Creatory					✓	✓	✓	✓					✓		✓	✓
Lego App4+													✓			
Monkey Lunchbox	✓		✓		✓	✓	✓	✓								
Mouse Maze																
Monster Chorus						✓								✓		
My Scene										✓	✓					
Playschool Art Maker										✓	✓	✓				
Singing Fingers									✓					✓		
Spot Goes to the Farm			✓	✓		✓										
Super Why!	✓	✓	✓	✓											✓	
Tally Tots					✓	✓										
Thomas the Tank Engine	✓		✓	✓			✓									
Where's My Water								✓								✓

### Appendix 3: Apps used by 5-6 Year Olds

APP NAME	LITERACY				NUMERACY						CREATIVE				SKILLS	
	Letter Recognition	Phonics	Words Recognition	Reading	Counting	Sorting/Classify/ign	Matching	Spatial	Add/Sub	Draw/Colour	Story Making	Scene Making	Design	Music Making	Fine Motor	Time Limit
AlphaTots	✓	✓	✓	✓											✓	
Dr. Seuss - The Cat in the Hat			✓	✓												
Futaba	✓		✓				✓									✓
Monkey Lunchbox	✓		✓		✓	✓	✓	✓								
Counting by fishdog.net					✓	✓										
Peppa Pig's - Fun at the Fair	✓		✓	✓						✓	✓					
Playful Minds					✓	✓	✓	✓	✓						✓	
Playschool Art Maker										✓	✓		✓			
Spot Goes to the Farm			✓	✓			✓									
Super Why!	✓	✓	✓	✓											✓	
Tally Tots					✓	✓										
Teddy's Day	✓		✓	✓					✓						✓	

#### Appendix 1-3 Notes

- **Sorting/Classifying** includes: sorting/pairing objects, number ordering, colour classifying, object classifying and patterning
- **Spatial** includes: size, shape & volume identification, angles and mazes
- **Matching** includes: puzzles and memory cards

## Appendix 4: Video Vignettes

### Videos of Lulu

Lulu will soon be 5 years old and she will start Kindergarten in the US in September. She has been playing with iPhone Apps since she was 18 months old. Now she has become adept at using the tablet that she called her 'big' iPhone when she used it for the first time. She demonstrates excellent tacit knowledge about the iPad shown by her ability to select games and play with them independently. She is able to articulate what is going on in the games and what she is doing as she participates. Her play on the tablet activities reveals that she has a good understanding of the foundational skills of literacy and numeracy.

#### 1. Ansel and Clair go to Africa

<http://www.youtube.com/watch?v=-fbfLlTFQc>

In this vignette Lulu turns on the tablet and selects a game called Ansel and Clair. The activity takes her to Africa where she finds out about the soft shell turtle and crocodiles. There is not much to do in the game except to navigate to the different parts where the action occurs (visual mode) and information is provided (aural). Finally, she takes a photo with the onscreen camera and places it in a travel book that is being compiled.

#### 2. Noodle words

<http://www.youtube.com/watch?v=DDzyfwOIDII>

<http://www.youtube.com/watch?v=rIsfQLcekdu&feature=youtu.be>  
Lulu says this is one of her favorite Apps. Words come on the screen and take on the characteristics of their definition. So the word 'pop' - does just that when you touch it. The word 'stretch' expands in front of your eyes. This game can help to build a young learner's vocabulary and assists them to understand definitions of words.

In the second clip Lulu makes the noodles dance as the word appears on the screen. When the word grow appears both the noodle people and some flowers grow taller as the word remains on the screen.

#### 3. Kindergarten reading

<http://www.youtube.com/watch?v=Ad8OdDXRQsk>

Lulu is looking forward to going to Kindergarten in the Fall. In this game she is playing with her tablet in the car. She has to follow directions to find the relevant sounds. In the first example she has to find items that have "i" in them, and in the second she has to find the letter for the sound "v". Lulu says she likes the game because it is about kindergarten.

#### 4. Wood Maze

<http://www.youtube.com/watch?v=er505y8qsYs>

Lulu is learning the foundational skill of matching in this App. She is matching some animals to their special foods. She has to use her fine motor skills to follow the food through the maze to the animal.

<http://www.youtube.com/watch?v=fDIEzckbFKY>

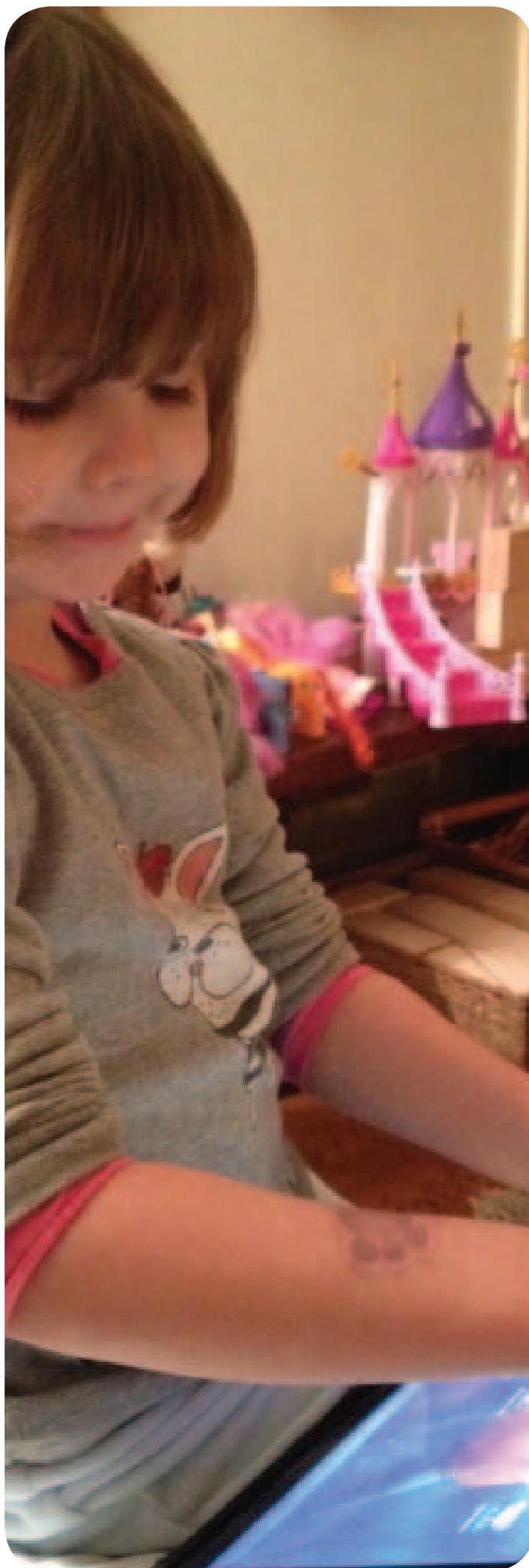
In the second vignette Lulu is again matching food to animals, and she tells us that by doing this she gets to help the animals too. She explains later in the sequence that she gets to help the baby animals find their Mummies. In the vignette there are also opportunities to match animal heads and bodies as well as counting fireflies and putting them in a jar. There is also a game that teaches the names of the baby animals.

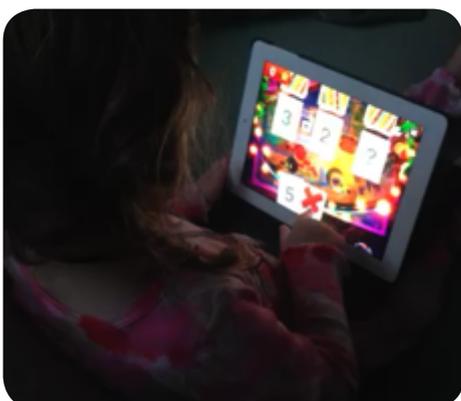
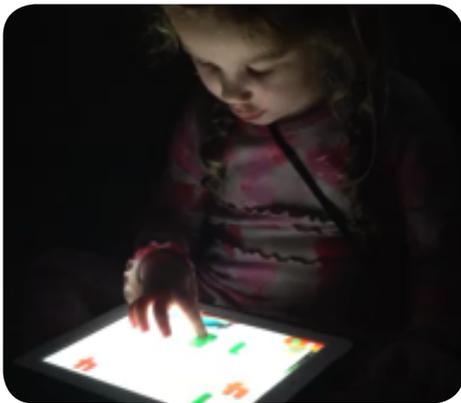
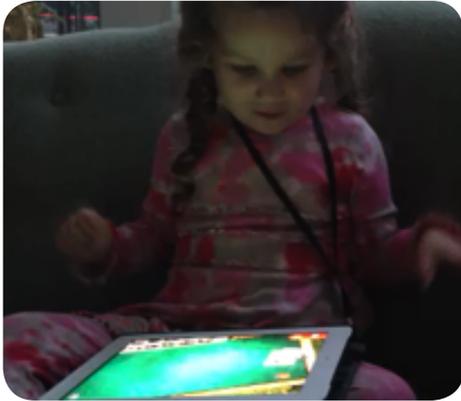
As Lulu is playing this game she creates a story to go with her activities. So while the game is closed and only allows for specific activities, Lulu has extended her learning by weaving in the opportunity to create a new story of her own. She has excellent language skills and is able to relate her story to her mother using complex language and sentence structures. As she tells the story she demonstrates her capacity to use intonation effectively with meaning to enhance the telling of the story.

#### 5. Toca Boca (music maker)

<http://www.youtube.com/watch?v=d6U0w6NZoMI>

This game teaches basic musical skills with pitch and sound variations.





## Videos of Sophia

Sophia is 3 years old and has been playing with iPhones since she was 18 months old. She is fluent in the use of her tablet. She mainly plays games using Apps and also watches pre recorded movies and TV shows.

### Sophia goes to Egypt

<http://www.youtube.com/watch?v=2mNWuW6IE3Y&feature=youtu.be>

In this game Sophia goes to Egypt and plays eye spy. She is asked to find various objects in the picture on the screen. These include a *scepter* and an *owl*.

### Sophia learns numerals

<http://www.youtube.com/watch?v=D2yKRjUvNhU&feature=youtu.be>

Sophia traces over a numeral that is spoken (orally) as it appears on the screen. A bee then flies over the numeral to show her how to trace this numeral with her fingers on the screen. She does this for the numerals 3 and 4. She notes and smiles as the bees fly away "They look like eleven!"

### Sophia plays a matching game

<https://www.youtube.com/watch?v=AETgHLKnWWho>

Sophia plays a matching game and explains: "You are supposed to match what you are doing!" This matching game requires matching numerals, shapes, and letters

### Sophia counts bugs

<http://www.youtube.com/watch?v=MQWFDZjy2ts>

This game has various components that are all to do with counting in the context of bugs. First you find bugs under everyday items and count them as you discover them. In another game bugs are crowded around a tin - you count them and select the numeral to match the number.

### Adding

<http://www.youtube.com/watch?v=A5X-pGbEVrw&feature=youtu.be>

Sophia (S) is given an addition algorithm (e.g.  $3 + 2 =$ ) and has to find the answer from one of three cards underneath it. Her mother (M) asks:

(M) How did you find that out Sophia?

(S) I put the cards on the right number.

(M) How do you find the right number?

(S) The right number is... when you put the right number the lady tells us to put on the right number.

