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Investigation of 3- to 4-Year-Old Children's Interaction with Literacy Teaching Apps

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Abstract: This study investigated use of iPad apps in young children's literacy learning. This study has two phases: app appraisal phase, and the child play phase. In the app appraisal phase, this study chose five available apps from the iTune recommended website. A GIARS rating scale was used to appraise the chosen apps in 10 areas in GIARS: age appropriateness, contextual environment, spatial design, seamlessness, scaffolding, non-violence, process orientation, real world model, and the anatomy of a gesture. In the child play phase, five 3-4 year old young children were observed while playing the apps to learn literacy. Early childhood educators and technician app developers will find this paper useful in conceptualising appropriate apps in young children's literacy learning.

Keywords: apps, literacy learning, young children

1. Introduction

The Australian Early Years Learning Framework (EYLF) explains that pedagogies refer to the 'practices that are intended to promote children's learning' (DEEWR, 2009, p. 46). An early childhood educator must decide upon which pedagogies are most effective for the manner and style with which their current circumstances dictate. Being that early childhood focuses on child-centered learning, initiated by the child during play and supported by other children and adults, compared to primary education, which is subject driven and facilitated by the educator (Gonzalez-Mena, 2008). Play-based learning is supported within the EYLF that indicates that children 'organise and make sense of their social worlds, as they engage actively with people, objects and representations' whilst engaged within play (DEEWR, 2009, p. 46).

More than five million Australians own tablet computers, with Microsoft tablets accounting for 52% of the market, making it the most commonly owned tablet computer within Australia (Ibrahim, 2013; Moses, 2013). Moreover, many apps have been developed for young children to play and learn with. Within the EYLF there is no specific definition of apps or games for educational purposes, however they do imply its use within the framework under the guise of 'technologies'. The technology includes much more than computers and digital technologies used for information, communication and entertainment (DEEWR, 2009, p. 46). These products have been extended beyond artifacts designed and include processes, systems, services and environments (DEEWR, 2009, p. 46).

By offering a child-friendly touch screen technology learning environment, children's play with iPad has become a topic that is of considerable interest for early childhood education audiences. Research indicates that children are developmentally ready to use digital play, and they are effective and engaged users of educational technology (Haugland, 2000; McCarrick & Li, 2007; NAEYC & Fred Rogers Centre, 2012). Although iPad apps should not fully replace other educational resources such as books to teach children to learn to read and write, they offer children an engaging environment to learn literacy with reinforcement of retention and comprehension. For example, to expand on the value of technology in children's learning, in their literature review, Couse and Chen (2010, p. 76) explain 'that children who use computers have been found to show greater gains in intelligence, structural knowledge, problem solving, and language skills compared with those who do not use technology in their learning'.

However, there are also studies showing that children who read on iPads have weaker literacy skills and are less likely to enjoy the experience of reading. A survey conducted by the National Literacy Trust (2012) in UK found that only 12 percent of children who read using iPads said they really enjoyed reading compared with 51 percent of those who read books. Based upon the above literature review of existing research conducted, this paper aims at investigating whether young children (up to 5 year olds) can be assisted in learning to read with use of iPads and what factors that influenced young children's literacy learning with use of iPads. Thus, this study was to investigate iPad games/apps in young children's literacy teaching and learning.

2. Methods

This paper has two sections of data collection: app appraisal phase and the child play phase.

In the first phase, to effectively appraise appropriate literacy apps, based upon Haughland Scale (Haugland & Wright, 1997), the Gestural Interface App Rating Scale (GIARS) was designed and it was used to find the apps' quality towards young children's developmental appropriateness (see Appendix). Ten apps were chosen from the Game Centre in Apple website in the literacy area of early childhood education. All the chosen 10 apps were measured in 10 areas in GIARS: age appropriateness, contextual environment, spatial design, seamlessness, scaffolding, non-violence, process orientation, real world model, and the anatomy of a gesture. Each area receives a score between 0-1, 1 being all components of the criteria met, 0.5 for partial components met, and 0 for no components met within the criteria. In addition, an anti-bias deduction is calculated from 0-1, to ensure software reflects the global, diverse nature of society, this being scored as 0 for met, or -1 for not met. A score above 7 is considered to be developmental software.

In the child play phase, five three to four years old children were invited to participate in this phase. It is based upon the fact that a) there are limited studies done on the use of educational media in early childhood settings, and b) children younger than 3 learn through their bodies: their eyes, ears, mouths, hands, and legs and that developmental skills of these children are learning to master are crawling, walking, talking, and making friends (Haugland, 2000). The researchers asked each child to sit with them in one on one setting with limited distractions firstly, then play together. The researchers observed the children' playing and the researchers did not supply cues that could affect any child participant's play or response. Qualitative comments were also recorded by the researchers.

Data were transcribed and entered into the Statistical Package for Social Science (SPSS). Data were analysed using the SPSS and alpha was set at 0.05 for purpose of the present study.

3. Results

3.1 App Appraisal Phase

Five apps were chosen from the Education-Reading section from the iTune store and were used in the observation for participating children's play in the area of English Alphabet for "under five years old children" education. The 5 Apps were Fun English, Elmo ABCs, Alphabet, ABC Music and Read English.

According to GIARS, a score above 7 is considered to be developmental appropriate software. All the apps were rated developmentally appropriate for young children (See Table 1). In Table 1, it also shows that there is no relationship among their price and their overall score in the rating of GIARS.

Table 1: Overall scores in the ten areas of GIARS

Apps	Price(AU$)	Overall score in the ten areas of GIARS
Fun English	Free	8.24
ABC Music	2.99	8.08
Alphabet	4.49	7.95
Elmo ABCs	5.49	7.59
Read English	0.99	7.38

Table 2 presents the different score of all the apps in each area of GIARS. It shows that different games have different individual scores in the 10 areas listed in GIARS. For example, there are no different scores in the areas of "Age appropriateness", "Spatial Design", and "No Touch Left Behind".

Table 2: Apps' individual scores in GIARS

	A	B	C	D	E	F	G	H	I	J
Fun English	1.0	1.0	0.5	0.88	0.75	0.75	0.67	0.7	1.0	1.0
ABC Music	1.0	0.83	0.5	0.75	0.75	1.0	0.5	1.0	0.75	1.0
Alphabet	1.0	0.83	0.5	0.75	0.75	0.75	0.67	0.7	1.0	1.0
Elmo ABCs	1.0	0.5	0.5	0.88	0.75	1.0	0.67	0.8	0.5	1.0
Read English	1.0	0.83	0.5	0.75	0.5	0.75	0.5	0.8	0.5	1.0

Note: (a) A = Age Appropriateness; B = Contextual Environment; C = Spatial Design; D = Seamlessness; E = Scaffolding; F = Non-Violence; G = Process Orientation; H = Real World Model; I = The Anatomy of a Gesture; J = No Touch Left Behind. (b) Individual Score is from 0 to 1.

3.2 Child play phase

Five pre-school children (two three-year-olds and three four-year-olds) participated in the child play phase. All participating children are females. This section is to report the participating children's action and behaviours individually when they are playing the five apps.

Each participating child was provided an iPad with all the five apps. All children had experience of playing iPad before; therefore they were not instructed how to turn on/off the iPad, and open the apps games.

The following observations are noted among the similarities of the five children's behaviours during playing.

Observation 1: All participating children played all five apps.

Observation 2: All children played individually for half an hour without stopping.

Observation 3: All children played the apps without asking for help from adults.

The following factors were also noted by the researcher which influenced children's playing.

Observation 4: All children used trial and error initially. It was categorised if the participating child was trying any answers randomly on the screen to find the correct answer instead of using appropriate comprehension or elements of the gestural interface. For example, a four year old child was playing the app "Fun English". The app was asking her to work on the spelling of the colour (See Figure 1). The child can move the letters with her figures and put them into the right place of the word. For example, if the child put the letter "G" in the first box, the letter stayed. Otherwise, the letter would drop to the bottom of the screen. The behavior was repeated in the following attempts until all the letters were in the correct places. Therefore, this game was set for the participating children to use trial and error to learn.

It was also noted that four year old children could remember the places of the letters when they were asked to play the game again, therefore when they were playing, they did not need to use trial and error for each letter. It was observed that the three year olds were using trial and error more often in the repeated game.

Figure 1. “Fun English” scene

Observation 5: All children used elements of Gestural Interfaces (GI). It was categorised if the participating children attempted to use elements of the gestural interface to assist with the cognitive load of answering the reading question.

The participating children were playing “Elmo ABCs”, the participants were asked to track down the letter. During playing, the children placed their fingers on the screen to copy the trace of the letter.

Figure 3. Examples of “Gestural Interfaces”.

Observation 6: When they children were playing together, older children initiated/distracted younger children in playing. It was noted during playing, the 3-year-olds were often distracted by the 4-year-olds playing. Sometimes the 3-year-olds would stop their playing and went to watch the 4-year-olds playing.

Observation 7: Older children ceased the younger children’s interruption. When the younger participating children were trying to tap on the older children’s screen, the older children tended to walk away with their iPad without playing together with the younger children. However it was observed that if the 3 year old children did not try to tap or interrupt the four year children’s playing, the older children would not stop the younger child from observing their playing experience. It was observed that all participating children showed signs of enjoyment whilst using the ipads, such as smiling and laughing.

Observation 8: It was observed that during play, all participating children used private speech whilst engaged with iPad use. For example, during playing the app “Alphabet” the participating child was trying to copy the sound of the letter herself privately (see Figure 4).

A 3-year-old was tapping on the “o” in the app Alphabet. The screen was showing the picture of some olives. There is also a sentence showing “O is for olives”. When playing, the 3-year-old child was murmuring “olive” privately when she was playing.

Figure 4. Examples of “the participating children’s own private speech during playing”.

Observation 9: The players terminated the game when the content was not engaging. It was observed that participating children terminated the app “Read English” within one minute of playing, and went to play other games instead. It is consistent with its score in GIARS rating. The players were able to choose the developmental appropriate games for themselves.

4. Discussion and Conclusion

This research investigated iPad games/apps in young children’s literacy learning. Although there are a lot of apps in children’s literacy, it was found that there were less than 50 apps on iTune recommended website. Moreover, there were less apps available for teaching children literacy on the iTunes recommended website and few were designed to teach young children (up to 5 year olds).

Based upon the use of GIARS, this research found not all the current iPad apps were developmentally appropriate for children, especially for children up to 5 years old. As required by

EYLF, there is no specific definition of apps or games for educational purposes, however they do imply its use within the framework under the guise of 'technologies' (DEEWR, 2009). However, this study also found the current apps from the Education-Reading section from the iTune store were appropriate in teaching young children literacy, such as in the area of learning the alphabet.

Another important finding for this study is that there is no correlation between price of the apps and the developmental appropriateness of the apps. However, it was noted earlier that there were only few apps recommended, the relationship between apps' prices and developmental appropriateness should be studied further when there are more recommended apps.

The present research also investigated young children's playing of the five chosen apps; and nine observations were noted in the results, which included a) young children could have sustained engagement playing iPad games (they played all the apps for more than 30 minutes); b) young children could use GI; c) young children used trial and error in their playing; d) during playing, young children could have interactions (such as talking and observing each other's games); e) young children used private speech when playing; and f) young children exercised options to terminate play with apps if the apps were not engaging. These findings were consistent with research such as Haugland (2000), McCarrick and Li (2007) and the NAEYC and Fred Rogers Centre (2012) that children are developmentally ready to use digital play, and they are effective and engaged users of educational technology.

There are a lot of limitations within this research. For example, the samples of participants were only five female children. Moreover, the present study did not research children's literacy level before and after their playing apps. Therefore, a further study will be designed to include more children to play apps. In addition, a proper test shall be designed and used to measure young children's literacy level before and after their playing. Moreover, the interactions between children will be studied further. Interactions between different genders when playing will also be investigated.

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Appendix: Gestural Interface App Rating Scale (GIARS)

App name: _____
Cost: _____

10 areas		**Not met (0)**	Partial met **(0.5)**	Met **(1)**
Age Appropriateness	Realistic Concepts			
	Appropriate Methods			
Contextual Environment	Minimal Interface Elements for Content			
	Sequence of Learning Present			
	A Clear Beginning			
Spatial Design	Support Using 2D			
	Adhere to Principles of 3D			
Seamlessness	Responds to Every Contact			
	Transitions Fluid			
	Single Finger Flick Movements			
	No Time-based Gestures			
Scaffolding	Appropriate Action Prompting			
	Functionality			
	Intentional User Input			
	Reversible Actions			
Non-Violence	App is free of violent characters and actions			
	App models positive social values			
Process Orientation	Discover Learning, Not Skill Drilling			
	Intrinsic Motivation			
	Process Engages, Product Secondary			
Real World Model	Accurate Information			
	Advertising is Minimal or Not Apparent			
	Concrete Representations			
	Objects Function			
	Simple, Reliable Model			
The Anatomy of a Gesture	Gestures are Minimal and Immediately Clear			
	Clear Feedback			
No Touch Left Behind	Precise Selection of Content			