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Observation of Children's Engagement when Playing iPads

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Abstract: This paper investigated 3-4 year old children's engagement levels while they were playing iPads. Observations were used in this study. Eighty students participated in this study. This paper made three important contributions, which include a) children's engagement levels were medium to high while playing iPads, which supports the play-based learning theory in early childhood education, b) young children can use touch screen technology and gestural interfaces in their learning, and c) children were having fun, expressed especially in their verbal languages and utterances. Early childhood educators and young children's parents may find this paper useful in providing access and guidance for young children to use iPads to play and learn.

Key words: engagement levels, iPads, play-based learning, touch screen technology, gestural interface

1. Play-Based Learning in Early Childhood Education

One of the biggest differences between early childhood education and other education is the manner in which educators address children's learning. Being that early childhood focuses on child-centered learning, initiated by the child during play and supported by other children and adults, compared to other education, which is subject driven and facilitated by the educator (Gonzalez-Mena, 2008). Play-based learning is also supported within the Australian Early YearsLearning Framework (EYLF)which 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).

From a developmental perspective, experts believe that symbolic and imaginative play provides the foundations for all domains of development (Ebbeck&Waniganayake, 2009). Gonzalez-Mena (2008) further justifies the use of play for children by explaining that play is a 'developmentally appropriate practice', in that it directly relates to children's stage of development as defined by theorists. However, other research also indicates that there is a growing concern of the value of play, especially in relation to the value of play over more structured work, such as drill-repetitive practice (Lim, 2010). Nevertheless, research clearly shows that play within the early years provides a meaningful and culturally responsive curriculum (Lim, 2010). Hence, it is important to differentiate play from work. Gonzalez-Mena (2008, p. 99) describes five tenants why play differs from work, they include that play involves: (1) active engagement, (2) intrinsic motivation, (3) attention to the means rather than the ends, (4) nonliteral behaviour, and (5) freedom from external rules.

2. Touch Screen Technology, Gestural Interface and iPads

Although it was not recommended that children under the age of three use digital play (Flynn &Chiten, 2008; Nielsen, Simcock, & Jenkins, 2008), research indicates that by three not only are children developmentally ready to use digital play, but that they are effective and engaged users (Haugland, 2000). Supporters for the use of educational technology within early childhood settings, such as McCarrick and Li (200), argued that the use involves children's strong motivation and engagement with the use of educational technology. Technology can be made more motivating and educationally effective by using animation and children's voices and giving simple, clear feedback (Clements &Sarama, 2007).The current study used an iPad as the technology of choice for the project. A number of factors led to this decision, these include the nature of the tablet interface for early childhood learners and the current popularity of tablet computers within Australia. A tablet computer is technology that is a gestured based mobile computer, which allows the user to manipulate technology via physical interactions (Anderson, Anderson, Simon, Wolfman, VanDeGrift&Yasuhara, 2004).

The interface associated with tablets involves the use of gestural interface devices. The use of gestural interface devices within the educational sector has been gaining momentum in schools and to a lesser degree, preschools for a period of time, for example smart board technology. The tactile nature of gestural interfaces fits well with early childhood pedagogies and the emergent fine motor development of children within the early childhood age range. Segal (2011), for instance, suggests that new technologies allow for new opportunities to include touch and physical movement, which can benefit learning in contrast to less direct methods such as somewhat passive interactions of a mouse and keyboard. Wigdor and Wixson (2011) describe these new technologies as natural user interfaces (NUI). They explain that NUI are potentially the next evolution in computing. As a new medium in the world of computing, Wigdor and Wixon (2011, p. 9) believe that the experiences created by the user interface of NUI and how those technologies are leveraged will potentially 'better mirror human capabilities, optimize the path to expert, apply to given contexts and tasks, and fulfill our needs'.

Within the scope of human abilities, embodied interaction involving digital devices is based on the theory of embodiment, that cognition is affected by our interaction with the environment. Embodied interaction involves more of our senses than traditional (mouse-based) interfaces, and includes touch and physical movement, which are thought to retain the knowledge that is being required. Research by Chan and Black (2006) found that immediate sensorimotor feedback received through direct manipulation of animation through the hands allowed for increased learning as compared to passive animation conditions. Furthermore, Saffer (2009) suggests that human beings are physical creatures and we like to interact directly with objects. Interactive gestures allow for this form of learning hence a greater likelihood of meaningful learning experiences. Therefore, gestural interfaces, such as the iPad provide a hands-on experience and support cognition as explained within embodiment. However, the design of the gestural interface and associated software will play a very large role in the effectiveness of such devices and ability to transmit knowledge.

There is a growing body of research on the nature of spontaneous gestures and their effect on communication, working memory, learning, mental modeling and reflection of thought (Segal, 2011). Research (Goldin-Meadow, Nusbaum, Kelly & Wagner, 2001; Kessell&Tversky, 2010) indicates that gestures augment working memory and serve communication for both memory and solution enactment. Gestures are actions and can help people imagine mental operations and perform mental transformations (Chu and Kita, 2011). Moreover, gestures reveal information about children's developmental stage and could support learning. For example, research by Goldwin-Meadow (2009) explains that gestures play a role in changing children's knowledge, as children can explain in gestures what they may not be able to do in speech. Goldin-Meadow, Cook and Mitchell (2009) further indicated that children produced a particular set of gestures while learning new mathematical concepts of grouping which aided in retaining knowledge and solving problems. Other researchers also found that children use gestures in mathematics frequently to comprehend as a problem-solving tool (Carlson, Avraamides, Cary & Strasberg, 2007).

In the light of the above literature review, the present paper aimed to investigate if and to what level areyoung children engaged with games using touch screen technology and gestural interfaces, and provide an in-depth understanding of use of the technology, in early childhood educational settings

3. Methods

This research used qualitative research methodology and observation research methods. Denzin and Lincoln (2005) stated that observation can be used as a "fundamental basis of all research methods" in social and behavioural science. Therefore, in this study, semi-structured field observation was used to collect information about children's engagement in child care centres.

3.1 Participants

Eighty children participated in this study. Of the 80 participating children, 44 (55%) were male, and 36 (45%) were female. Forty (50%) participating children were from South Australia, and forty (50%) were from Northern Territory of Australia.The age range was from 36 months (above 3 years) to 59 months (under 5 years old). Children were classified as 3-4 years age group (43.8%), and 4-5 years age group (56.3%).Of the 80 children, 12 children (15%) were attending child care centre(s) full time (10 sessions per week), 68 children (85%) were attending child care centre(s) between 4 sessions to 8 sessions.

3.2 Instrument

The tool "*Assessing for learning and development in the early years using observation scales: Reflect respect relate*" from the Department of Education and Children Services (2010b) was used to analyse the participated children's engagement or involvement in playing the iPad2 game. The Involvement Scale (DECS, 2008, p. 81) described nine signals that a child participating in an activity was indeed 'involved', they include: (1) *concentration*, (2) *energy*, (3) *complexity/creativity*, (4) *facial expression and posture (non-verbals),* (5) *persistence*, (6) *precision*, (7) *reaction time*, (8) *verbal utterances/language*, and (9) *satisfaction*. The rating within each signal was designated as 1, m or h and the aggregation of those signals ranked the observation on a scale, being: (1) scale rate 1-no activity, (2) scale rate 2-frequent interrupted activity, (3) scale rate 3-more or less maintained activity, (4) scale rate 4-actvity with intense moments and (5) scale rate 5-sustained intense activity. The scale rate also had descriptors to assist in grading, for example scale rate 1-no activity, was where the child showed the indicators of (1) no concentration: staring daydreaming (2) an absent, passive attitude (3) no goal-orientated activity, aimless actions, not producing anything (4) no signs of exploration and interest, and (5) not taking anything in, very little mental activity.

3.3. Procedure

All children participating in the proposed research were observed during their first use of the iPad, and 5 times after for a total of 6 observations. Each observation was two-minute in duration, started at anytime whilst the child was using the iPad2 and continues. After a two minute observation, the researcher took time to make notes and fill out the rating. Each observation required a score sheet and label for each child for the 6 observations.

Data were transcribed, entered and analysed. The researcher took approximately 4 weeks to enter all the written answer in to the Statistical Package for Social Science (SPSS), and spent another week to confirm all the data were entered correctly.

4. Results

This section reported children's engagement in playing Apps based on the Engagement Scale (DECS, 2008) in the areas of Concentration, Energy, Complexity and Creativity, Facial expression and Posture, Persistence, Precision, Reaction time, Verbal utterances and Language, and Satisfaction. Each child was observed six times on these six areas with 2 to 5 minutes apart from each other. Each time all the six areas were rated using a 4-point scale (0 = no engagement, 1 = low engagement, 2 = medium engagement, and 3 = high engagement).

Table 1 presents the means and standard deviations of the six areas. It was found almost all the areas other than "Verbal utterances and Language" were rated above "medium engagement". Among them, the areas "Facial expression and Posture", "Persistence" and "Concentration" were rated closer to "high engagement". A repeated measures ANOVA was applied across the 9 frequencies. A significant effect was evident (see Table 1). This suggests that all areas in engagement scale were discriminating effectively between the items.

Table 1:Engagement of children's playing Apps (means)

	Mean	*SD*	*N*
• Facial expression and Posture	2.90	.47	80
• Persistence	2.83	.50	80
• Concentration	2.80	.47	79
• Reaction time	2.50	.57	80
• Precision	2.39	.65	80
• Satisfaction	2.26	.51	80
• Energy	2.23	.50	80
• Complexity and Creativity	2.05	.37	80
• Verbal utterances and Language	1.79	.64	80

Note: (a) The means were presented in order, from highest to lowest, using 4-point scale anchored (0 = no engagement, 1 = low engagement, 2 = medium engagement, and 3 = high engagement). (b) A repeated measures ANOVA on the above means revealed a significant effect, $F(8, 624) = 90.17$, $p < .01$.

It was of considerable interest to investigate the relative engagement among these different 9 areas. That is, they were rated across the areas, and thus it is of value to examine for differences across the areas in average ratings.The ratings of Concentration, Energy, Complexity and Creativity, Facial expression and Posture, Persistence, Precision, Reaction time, Verbal utterances and Language, and Satisfaction, are significantly related, $p < .05$. Figure 1shows that Facial expression and posture was rated highest and Verbal utterances and Language was rated lowest.

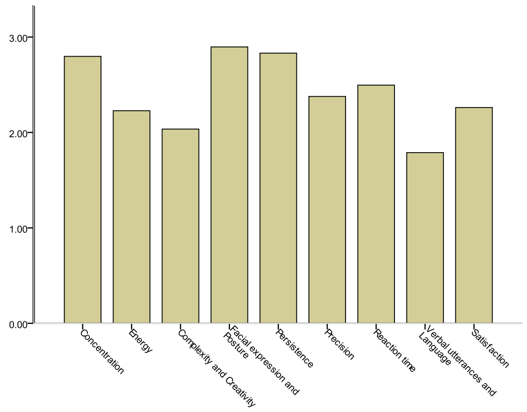

Figure 1. Means of ratings of Concentration, Energy, Complexity and Creativity, Facial expression and Posture, Persistence, Precision, Reaction time, Verbal utterances and Language, and Satisfaction

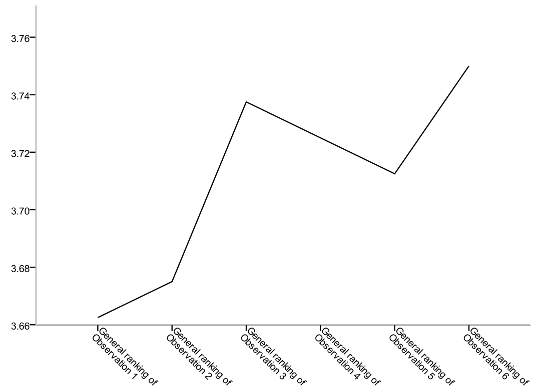

Figure 2. Means of general ranking of 6 observations.

General ranking in each observation were also rated from 0 (no engagement) to 5 (high engagement) in children's engagement. General ranking was also rated 6 times per child. It was found the mean of general ranking for all the participating children was 3.71, and standard deviation was .87.

It was of interest to find whether there was an improvement for the participating children in their general ranking from the first observation to the last observation. It was found there was no significant improvement between the first observation and the last observation, p = ns. However, there were some minor differences among the general ranking over 6 observations (see Figure 2).

5. Discussion and Conclusion

Use of iPads and touch screen technology in children playing can provide children with a user-friendly and fun learning environment and access to learn and develop their fine motor skills(Allen &Marotz, 2010), as long as the appropriate games or apps were chosen for the children.

This study makes three important contributions to our knowledge on the use of iPads in young children's engagement in playing and learning. One, children can engage themselves very actively in playing iPads. This finding was consistent with Gonzalez-Mena (2008) description that these children's engagement in the almost all the areas other than "verbal utterances and language" were active engagement, and emphasised that playing with iPads can assist children with organising, and making sense of their social worlds (DEEWR, 2009).

Two, playing iPads provided fun to young children while they were playing. The score in the nine areas in engagement scale presented that most participants had high facial expressions while playing iPads. These findings supported Anderson et al (2004) and Clements and Sarama (2007)'s statements that iPads can allow children to have sense of fun through physical interactions with the softwares provided by touch screen technology.

Three, as to the relationship between the use of iPads and touch screen technology, the findings from this study agreed with Wigdor and Segal (2011)'s suggestions that touch screen technology can benefit children's learning in contrast to a mouse and keyboard. The gestural interface provided by iPads can be leveraged better children' learning needs (Chan & Black, 2006; Saffer, 2009; Wigdor&Wixon, 2011).

There are several limitations for this paper: a) the enjoyment levels while children playing iPads were not analysed; b) children's fine motor skills development were not analysed by using the Engagement Scale; and c) the data was based exclusively on the students' observations. The data was based solely upon 80 children in South Australia and Northern territory in Australia. These factors limit generalisation to the student population as a whole.

Therefore, a number of research directions can be identified. Data needs to be gathered from children from other disciplines and from other geographical regions. Future research will also need to be undertaken to further explore children's enjoyment levels in playing iPads. Future research will also need to focus on what kind of iPad games can help children improve their learning outcomes, such as in the areas of literacy and numeracy. Last but not least, further study will be needed to investigate how educators from child care centres and young children's parents' attitudes could influence children's access and skills in iPads within and outside child care centres to better support children's learning.

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