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A Case Study: ExploringVideo Deficit Effect in 2-Year-Old Children's Playing and Learning With an iPad

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Abstract: This paper examined 2-year-olds' playing with an iPad and whether there is a video deficit effect, that young children learn less from an iPad than from a live demonstration. Observational case study has been used in this study.This paper made three important contributions, which include a) there was a video deficit effect, which exists at least before the child turned 3 years old and it was found young children (2-year-olds)'s poorer ability to learn from 2D sources (iPad) to real-life situation, in comparison to their ability to learn from a live demonstration, b) 2-years-olds could not draw a whole cat image, owing to that children's understanding from playing theiPad game was linked with their thinking, talking and reading from the images and iPad games only provided children with higher task complexity and disrupt their transferring of learning; and c) 2-year-olds needed to develop their experience with multiple representations, such as language cues, to facilitate their transferring of learning. Parents and teachers may find this paper useful to examine the values of using 2D sources, such as an iPad.

Key words: video deficit effect, iPad, children's drawing

1. Video Deficit Effect

In 2005, Anderson and Pempek (2001) proposed a video deficit effect, which refers to young children's poor ability to transfer learning from television and videos to real-life situation, in comparison to their ability to transfer learning from face-to-face interaction. In McCall, Parke and Kavanaugh's study (1977), they tested that young children, aged under 36 months old, could imitate from a black-and-white television, but has poor performance to the groups of same aged children who had been shown by a live demonstrator. It was also been tested in other studies that this video deficit effect exists at least till the child reaches 3 years old (Barr, Gracia&Muentener, 2007a; Barr Muentener, Garcia, Fujimoto & Chavez, 2007b; Deocampo& Hudson, 2005; Flynn & Whiten, 2008; Hayne, Hisbert, &Simcock, 2003; Nielsen, Simcock& Jenkins, 2008). For example, in Zack, Barr, Gerhardstein, Dickerson, and Meltzoff's study (2009), it was found that the young children exhibited a typical video deficit effect in 2D to 3D transfer. However, recent research found when the young children turned 5, the differences between the live group and video group disappear (Flynn & Whiten, 2008; Zack, Barr, Gerhardstein, Dickerson &Meltzoff, 2009; Gerhardstein, Dickerson, Zack & Barr, 2009). Therefore, learning is affected by the nature of children's development and experience of watching television and videos.

Researchers have investigated whether the video deficit effect can be ameliorated (Barr, Rovee-Collier &Campanella, 2005; Rideout, Vandewater&Wartella, 2003; Skouteris& Kelly, 2006). Barr (2010) also concluded six factors that may assist ameliorating the video deficit effect.

1) **Repetition** (Barr et al., 2007a; Barr &Wyss, 2008; Carver, Meltzoff& Dawson, 2006; Simcock&DeLoache, 2006;Zack et al., 2009;). Repetition can enhance encoding, thus increase the chances of the transfer because of the processing time.

2) **Prior experience** (Hauf, Aschissleben&Prinz, 2007; Skouteris, Spataro&Lazaridis, 2006; Troseth, 2003). It was found that young children's prior experience with the object, led to a viewing preference for the 3D objects, because young children prefer familiar information.

3) **Working memory demands** (Hauf, 2009; Strouse&Troseth, 2008; Suddendorf, 2003). It was found that task complexity influences learning from television, and high working memory demands may disrupt the transfer of learning.

4) **Formal features**(Aschissleben, 2006; Barr et al., 2007a; Barr et al., 2007b; Barr, Shuck, Salerno, Atkinson &Linebarger, 2010; Klein, Hauf&Aschissleben, 2006). It was found that video deficit reflect the young children's difficulty in understanding the action-based information and transferring it to their behavioural repertoire.

5) **Language cues** (Hayne et al., 2003; Booth & Waxman, 2002; Waxman, 2008). Language may first facilitate transfer of learning, however, only to the groups of older children over 15 months, especially for the children over 2.5 years.

6) **Social contingency** (Flynn & Whiten, 2008; Nielsen et al., 2008; McGuigan et al., 2007; Calvert, Strong &Gallaghis, 2005; Huang &Charman, 2005; Troseth, Saylor &Archis, 2006). The studies show that the social behaviours may be less likely to transfer from a video than a live demonstration.

Early screen media (such as television, computers and videos) has been exposed to young children under 3 years old. For example, television programs such as Teletubbies, In the Night Gardenwere produced specifically for the age group of children under 3 years old; and parents were using this kind of media to engage their children to learn. However, with more popular touch screen technology's use with young children, such as iPad and its applications designed for young children, there is a need to study whether the new form of media will provide early childhood educators and parents a view about the issue of video deficit effect.

2. Children's playing and Learning with iPads

Within Australia there are a variety of tablets available for personal and technical use. Consumer studies show that more than a quarter of a million Australians are using Apple's iPad, making it the most commonly owned tablet computer within Australia (Colley, 2010). With an already high demand for theiPad, in May of 2011 Apple introduced onto the market the iPad2 (Griffith, 2011). On Apple website(2011), it explains that the iPad2' features a large, high-precision, touch-sensitive display that requires no physical force, just simple contact with its surface'.

Connecting learning through iPad to the early childhood pedagogy of play is the term 'digital play', which is 'play with digital devices and media; this includes children's play with computer software and game consoles that connect to a computer' (Highfield, 2010). From a developmental perspective, experts believe that symbolic and imaginative play provides the foundations for all domains of development (Ebbeck&Waniganayake, 2010). 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. Moreover, within early childhood settings 'play and learning are inextricably woven together; play is intrinsically motivated and powerful for children in all cultures' (Ebbeck&Waniganayake, 2010).

Linked to both cognitive and physical development is the ability of children to learn from a two dimensional (2D) source (such as an iPad) and translate that learning to three dimensional (3D) object response. Effectively, if children are not able to translate 2D images on a touch screen to 3D objects in real life then the potential for learning will be diminished greatly. Gonzalez-Mena (2008) stated that there are significant developmental changes in a "representational flexibility" which can occur in young children's learning process, and the gradual developmental change occurs when young children encode information from a 2D resource to a 3D objects. Other researchers also agree that young children can form an internal mental representation of the target 3D objects when it is demonstrated depending on the features of the context in 2D resources (Barr, 2010; Couse & Chen, 2010). It has been tested that there is a transferring of learning across the learning content and context (Barr, 2010; Gonzalez-Mena, 2008; Gerhardstein&Rovee-Collier, 2002).

The interface associated with iPad involves the use of touch screen technology. The use of touch screen technology within the educational sector has been gaining momentum in schools and to a lesser degree, preschools for a period of time. The tactile nature of touch screen technology fits well with early childhood pedagogies and the emergent fine motor development of children with the early childhood age range. For example, in one of the few research projects done on tablet computers and preschool aged children, Couse and Chen (2010) explain that young children between the ages of 3 and 6 years old were able to quickly learn to use the touch screen technology as a medium for

representing their ideas and learning'. Recently touch screens have also been used to investigate learning. Some researchers such as Gerhardstein and Roveen-Collier (2002), Sutton (2006), Subiaul, Cantlon, Romansky, Klein, and Terrace (2007) and Zack et al (2009) have already studied the touch screen technology with the imitation for young children to transfer from 2D to 3D and vice versa. It was found in the Zack et al's study (2009) that children can imitate target actions on the 2D touch screen and with the 3D objects, and children can also imitate across dimensions. Young children can learn from touch screen technology as it can provide a specific form of transferring of learning from a 2D source to a 3D object response (Barr, 2010; Durkin & Blades, 2009).

To sum up, there are concerns from researchers and educators about the challenges and issues of using iPad in early childhood educational settings. For example, thereis limited literature on whether the use of touch screen technology can assist young children's learning in their cognitive and physical development, because young children learn through their bodies, such as their eyes, ears, mouths, hands, and legs (Haugland, 2000).There is also limited research conducted to measure whether young children can learn cognitively by using an iPad as well as a live demonstration, although it is acknowledged that touch screen technology has been used widely around with young children. In addition, little research has been conducted about whether young children, especially preschoolers, are able to learn in the process of digital play and learning to understanding the concepts of 3D objects. Therefore, this paper aims to examine 2-year-olds' playing with an iPad and whether there is a video deficit effect, that young children learn less from an iPad than from a live demonstration.

3. Methods

This research used observation qualitative research methodology. Observational case study has been conducted in this study. "A case study of a current phenomenon for which observations could be used to supplement documents and interviews is called an observational case study" (Wiersma&Jurs, 2009). Observation as a "fundamental basis of all reserch methods" in the social and behavioral science (Denzin & Lincoln, 2005). Denzin and Lincoln (2005) furthis stated that it is possible to conduct observations in settings that are natural loci of those activities that may be the result of a controlled experiment.

In this study, children's drawings were used as an assessment method against their learning outcomes. Children's drawing is closely linked to their thinking, talking, reading, and writing. Children express and interpret meanings in mark making and drawing as well as in speaking and writing (Clay, 1998; Yang & Noel, 2006). Drawings are one of the most primitive forms of children expression and communication (Mitchell & Ziegler, 2007). Kress (1997) and Steel (1999) also agreed with it that the drawings were regarded as an effective means for children to explore their understandings. Stanczak(2007) states that the meaning of the images represents most importantly in the way that children interpret those images. Cox (2005) further states that drawing is a constructive way of thinking-in-action.Young children's views and experiences can be assessed by paying attention to their narratives and interpretations as they draw as well (Clark, 2005a; 2005b; Dockett& Perry, 2005; Punch, 2002; Veale, 2005).

A great amount of existing research analyses the graphic, perceptive and psychological aspects of children's drawings (Pillar, 1998). For example, the characteristics which may influence children's drawing may include the drawing context (Cox, 2005), cultural context (Cox, Perara& Fan, 1999), peer interaction (Anning, 2002; Anning& Ring, 2004; Richards, 2003; Thompson, 1999) and interaction with adults (Braswell &Callanan, 2003; Rose, Jolley&Burkitt, 2006).

In summary, the process of drawings and the accompanying narrative are integral parts of the meaning-making process (Cox, 2005; Einarsdottir, Dockett& Perry, 2009; Wright, 2007), and the aim of asking children to explain their drawings is to avoid adult interpretation of drawings(Merry & Robins, 2001). 'Young children draw what they know while the old children draw what they see' (Willats, 2005), and children learn to draw and draw to learn (Denzin& Lincoln, 2005). Óskarsdóttir(Oskarsdottir, 2006) and Einarsdottira et al (2009) have used children's drawings to assist teachers examine the beliefs and values underlying their pedagogical practices. In addition, the

longitudinal study of young children drawing by Anning and Ring (2004) and Ring (2006)has extended our understanding of drawing as a tool for constructing and sharing meaning.

Therefore, in this research, the participating children's drawings were used as to assess their learning outcomes, and during their drawing process, the participating children were asked to interpret their thoughts and ideas.

3.1 Participant

One female, Child A has participated in this research. She is a normal-developed child in Australia. She was 2 years and 5 months old when she initially participated in this research.

3.2 Procedure

The research was conducted in a quiet household environment. The case study has two phases.
Phase 1: Child A was introduced to understand the animal of "cat". She was shown how to play an iPad game/program called 'Animals 360', in which audiences were introduced with a 360° view on the world of animals, with their features, habitats and sounds. She had 30 minutes of playing the game, and then was asked to draw a picture of cat with pen and paper within the following 15 minutes. Observation was undertaken with the minimum of disruption during the procedure. Child A was invited to talk and interpret her drawings during the period, and a short conversation between the participating child and the researchers were carried out in the process.Questions such as "Could you tell us what you are drawing?" were asked. Notes of child's answers were taken.
Phase 2: Child A was introduced to a live cat, which she could touch as well as observe. She was then asked to draw pictures of cat, when the cat was present. During her 15 minutes' drawing, the child was also invited to interpret about her drawing. Observations were also carried out with the minimum of disruption during the procedure.

4. Results and Discussion

Child A spent approximately15 minutes on playing the game; and she demonstrated her understanding of the image of a cat in the iPad game, by pronouncing clearly and correctly the word "cat" during the courses of playing the game and drawing her cat. However, Child A's drawing lost traces of a cat (see Figure 1). When she was asked to interpret her drawing, she could not explain clearly the cat's body parts she was drawing.

The findings agree with the Stanczak's (2007) statement that the meaning of the images represent most importantly in the way that the participants interpret those images by using language cues. Owing to her age, Child A could not use proper language to interpret her drawing. However, the findings are consistent with Willats' (2005) statement that young children draw based upon their knowing, while old children draw based on their seeing and their drawings were linked to their thinking, talking and reading (Yang & Noel, 2006).

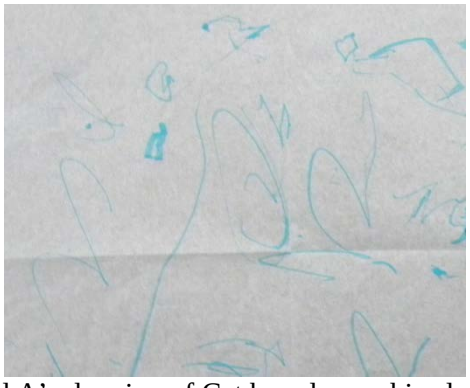

Figure 1. Child A's drawing of Cat based upon his playing with iPad

The finding also shows a process of drawing and accompanying narrative, which are integral parts of the meaning-making process (Cox, 2005; Einarsdottir et al., 2009; Wright, 2007). Child A used images and verbal signs to convey the meaning of her drawing (Wright, 2007).

Owing to Child A's age, she was still in the scribble stage of children's drawing development. Therefore, she could not draw a complete image of a cat, which she may need to develop this experience with multiple representations to form the same perception. However, it agrees with Booth and Waxman (2002), Hayne et al. (2003) and Waxman (2008)'s statement that language cues may facilitate transfer of learning, especially for the children under 3 years.

Child A was then asked to draw a cat image based upon her experience with the live demonstration (a real cat). Instead of drawing one image, she drew five images to show her understanding of a live cat (see Figures 3,4,5,6 and 7).

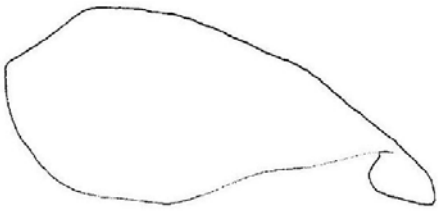

Figure 2. Child A's drawing of a cat body

Figure 3. Child A's drawing of a cat head

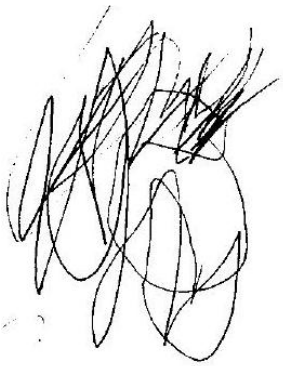

Figure 4. Child A's drawing of a cat's hair

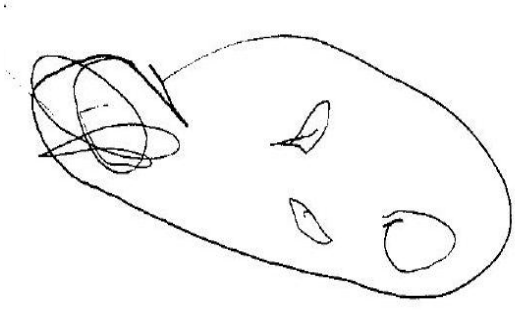

Figure 5. Child A's drawing of a whole cat (1)

Figure 6. Child A's drawing of a whole cat (2)

Figures 2, 3 and 4 shows Child A's understanding of a live cat. In Figure 2, Child A caught an important feature of a cat's body: A tail. Figure 3 shows Child A's transfer of learning about a cat's head with two large eyes. Child A also tried to draw a cat's hair with the hair sticking around the whole body in Figure 4. These findings are consistent with Michell and Ziegler's statement (2007) that drawings are one of the most primitive forms of children expression and communication. They also show Child A's views of cat's body, hair and head and experiences by touching cat's hair. It agrees

with Simcock and Deloache's findings (2006) that young children can imitate from a live demonstration. In Figures 5 and 6, Child A drew pictures of a cat by describing his understanding of a cat's whole body. The findings show children's expressions of their drawing's meaning and understanding (2006). The findings also agree with theStanczak's(2007) statement that the meaning of the images represent most importantly in the way that the participants interpret those images by using language cues. In addition, the findings are consistent with Willats' (2005)statement that young children draw based upon their knowing, while old children draw based on their seeing. Child A drew five images to demonstrate her understanding not her viewing of the cat. It is linked to his thinking, talking and reading (Clay, 1998; Yang & Noel, 2006).

In terms of the differences between the pictures of Child A's drawing of a 2D images from playing with iPad (see Figure 1) and a live cat (see Figures 2-6), the findings showed there is a video deficit effect, which exists at least the child turned 3 years old (Anderson et al., 2001; Barr et al., 2007a; Barr et al;, 2007; Deocampo& Hudson, 2005; Flynn & Whiten, 2008; Hayne et al., 2003; Nielsen et al., 2008). Although Child A also demonstrated a full understanding of a cat, she could not draw a cat based upon her understanding of theiPad game. In comparison, she could draw different kinds of cat's body parts and whole cat pictures based upon her understanding of a live cat.

5. Conclusion and future research

Overview, this paper examined toddlers' playing with iPad and whether there is a video deficit effect, that young children learn less from an iPad than from a live demonstration. It was found young children (2-year-olds)'s poorer ability to transfer learning from 2D sources (iPad) to real-life situation, in comparison to their ability to learn from a live demonstration.

This study makes threeimportant conclusions to our knowledge on use of iPad in early childhood education settings. One, although 2-year-olds could demonstrate their understanding of a cat while playing with an iPad, they could not draw a whole cat image. It may be owing to that (a) children's understanding from playing theiPad game was linked with their thinking, talking and reading from the images and (b) iPad games only provided children with higher task complexity and disrupt their transferring of learning (Yang & Noel, 2006).

Two, when children were exposed to a variety of different experiences of learning, such as touch screens, they need to develop their experience with multiple representations, such as language cues, to facilitate their transferring of learning, especially for children under 3 years old. In this study, it was found that the use of drawing and language cues could not help children under 3 years old to interpret their understanding of concepts from playing with an iPad. For example, Child A had not yet developed the language communicative abilities; therefore her drawing could not be interpreted properly. These findings are consistent with Michell and Ziegler's statement (Michell& Ziegler, 2007) that drawings are one of the most primitive forms of children's expression and communication and also agree with the statement that drawing and accompanying narrative are integral parts of the meaning-making process (Cox, 2005; Einarsdottir et al., 2009; Wright, 2007)

Three, In terms of the differences between the pictures of Child A's drawing of a 2D images from iPad and a live cat, the findings showed there is a video deficit effect, which exists at least before the child turned 3 years old(Anderson et al., 2001; Barr et al., 2007a; Deocampo& Hudson, 2005; Flynn & Whiten, 2008; Hayne et al., 2003; Nielsen et al., 2008). For example, Child A could not draw a cat based upon her understanding of theiPad images. In comparison, she could draw different kinds of cat's body parts based upon her understanding of a live cat.

There are limitations for this research. The data was solely based upon one case study, which may limit the generalisation among other children. Therefore, a number of research directions can be identified. Further research will be conducted with more participating children from different age groups. In addition, further research will be undertaken about young children's interaction while drawing in pairs or groups.

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