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Author/s:
Hatzigianni, M;Gregoriadis, A;Karagiorgou, I;Chatzigeorgiadou, S

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Using tablets in free play: The implementation of the digital play framework in Greece

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Practitioner notes

What is already known about this topic

- Pre-schoolers' use of digital tablets is steadily growing.
- Young children like using tablets as they are easy to use, portable and have a range of apps and games.
- Research has explored mostly the educational benefits from the use of tablets, but not so much the association with play.

What this paper adds

- Information on the use of tablets in an underexplored/underrepresented cultural context (Greece).
- Trial of a tool, the digital play framework, developed in Australia, in a different context, the Greek context.
- More evidence on the positive impact of the use of tablets on children's play.

Implications for practice and/or use

- Extending the evidence base of a theoretical tool and its suitability for EC education
- Digital technology works in synergy with play and is not a threat.
- Contribution to knowledge/literature about the association of digital technology and play with young children.
- Suggestions for further research around digital play.

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Title: *Using tablets in free play. The implementation of the digital play framework in Greece.*

Authors: Maria Hatzigianni[1], Athanasios Gregoriadis[2], Ioanna Karagiorgou[2], Sofia Chatzigeorgiadou[2]

[1] Macquarie University, Australia

[2] Aristotle University of Thessaloniki, Greece

Biographies

Maria Hatzigianni, PhD, is an Early Childhood Lecturer at the Department of Educational Studies, Faculty of Human Sciences, Macquarie University, Australia. Maria has published widely and her most recent project focuses on the use of technology by very young children; design thinking and makerspaces. She also has extensive experience in Early Childhood Education as a teacher and Director. Email: maria.hatzigianni@mq.edu.au

Athanasios Gregoriadis, PhD, is an assistant professor in Early Years at the Aristotle University of Thessaloniki. His main research interests include teacher-child relationships, quality of early childhood education environments, professional development and the support of home learning environments. He has participated in several international research projects funded by the EU and has published widely.

Ioanna Karagiorgou, PhD, is the director of the 2nd and 3rd Experimental kindergartens of Thessaloniki and has received several awards for her work. She has participated in European and nationally funded projects and has several publications.

Sofia Chatzigeorgiadou, PhD, is a kindergarten teacher at the 2nd and 3rd Experimental kindergarten schools of Thessaloniki and has received several awards for her work. Sofia has participated in several European and nationally funded projects and has several publications.

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Abstract

The use of tablets in a Greek kindergarten class (16 children aged 4 to 5) under the digital play framework (Bird & Edwards, 2015) is explored in this study. The Vygotskian framework was adapted with permission in the Greek language and socio-cultural context. The aim was to understand children's use of new, touchscreen technologies, but also to identify a useful way to observe the progression of that engagement. The project lasted for four months and children were observed ten times (written and video recorded observations). Children were observed in pairs or small groups during their free play with the tablets. Findings suggest that the adapted framework was particularly helpful, when observing children, but could benefit from more flexibility and a less linear structure. Children went through the different stages of the framework using social scaffolding as their most dynamic strategy. This study is significant as it reports on an underexplored context going through a range of social and political transformations (Greece), but also because it provides further insights on how to more efficiently document and assess children's play with technology.

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Introduction

The integration of technology in the early years of education has followed a rocky path, with many obstacles to overcome. There has been much scepticism from educators, due to the immense importance of this age for all areas of development (Aubrey & Dahl, 2014). Nevertheless, engagement with mobile and touchscreen technologies from a very young age is now an unquestionable reality for a large majority of children in the developed world.

Research on positive outcomes from the use of new digital technologies in specific learning areas, such as mathematics (Kyriakides, Meletiou-Mavrotheris, & Prodromou, 2016; Papadakis, Kalogiannakis, & Zaranis, 2016) or literacy (Merchant, 2015; Wohlwend, 2015) is steadily growing. In contrast, the combination of 'play' with 'technology' has not been well understood (Yelland, 2011). Play and 'free play' in particular has always been important in early childhood education (ECE) and its vital role in children's learning and development has been widely recognised. A growing body of evidence highlights the potential of enriching play with digital devices and new forms of technology (e.g. virtual reality from Marsh, 2010). As explained by Fleer (2014, p. 202) 'virtual imaginative play for pre-schoolers appears to invite a new kind of play…', a kind of play that demands alternative theories and perspectives. Her qualitative study on how digital tablet technology is introduced during free play in an early childhood setting with 25 children in South Australia, revealed that children's play was becoming more complex; transitions between play and learning were facilitated and children could reflect on their actions.

Concentrating on the social dimension of digital play Arnott (2016), Shifflet, Toledo & Mattoon (2012), and Verenikina, Kervin, Rivera and Lidbetter (2016) all agree on the positive influences of working with tablets on collaboration and co-operation. Arnott (2016) concluded that children's digital play is not only influenced by one element, and is not unique or one-dimensional. Children actively participate in digital play, and both influence and are influenced by technological tools. Play is evolving as a process with the help of new technologies and teachers should take this opportunity to critically reflect on their practices and understandings.

It is evident from the literature that context, participants involved and the design of apps are all crucial elements when exploring children's play in connection with new technologies. However, although interest in this area is growing, very little has been reported from countries that are not traditionally considered as 'technologically advanced', such as Greece. According to Fleer (2014), the cultural and historical context provides the 'roots' where play is learned, and recent studies have steered away from the maturational view of play which describes a predetermined, universal process where children develop in pre-set stages with little room for diversity or culturally constructed experiences.

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The digital play framework

Together with research around the use of new technologies by young children significant attempts have also been made to assist EC educators to understand the pedagogical value of the use of technology as a new type of play. One such attempt was the innovative development of a 'digital play framework' (DPF) by Bird and Edwards in 2015. The DPF was designed and implemented in Australia and its primary aim was to enhance educators' understanding of how children learn to use technology through play. It was used 'as a new assessment tool aimed at helping educators to understand how children learn to use technologies through play' (Edwards & Bird, 2015, p. 2) and also plan, observe and integrate technologies with a play-based approach (Bird & Edwards, 2015).

The framework was theoretically based on Vygotskian perspectives and follows Hutt's (1971) theory where exploration and play are distinct behaviours. Children first explore the tool ('the novel object'), and this is the 'epistemic' behaviour (from the Greek verb: 'epistamai' = understand, know) trying to understand technical and functional operations, 'what does this object do?' (p. 246). During these exploratory activities, children have a specific goal, their behaviours are more set and controlled, their attention is highly focused and usually they learn new skills and acquire new knowledge during this stage. Similarly, in the DPF the epistemic play is subdivided in three stages:

a) exploration: children understand the basic use/operation of the device;
b) problem solving: trying out different functions of the device to achieve their aim; and
c) skill acquisition: build on their knowledge about the device by sharing their understanding/actions with others.

Children then may progress to the more advanced form of exploration, what Hutt calls 'diversive exploration' or playful activities (1971, p. 248), the ludic behaviour (from the Latin word 'Ludus' = play, games etc), the emphasis now is on 'what I can do with this object' (p. 246). During ludic play children repeat what they already know, they are more relaxed and more emotionally involved, they don't have a well-defined goal to achieve, their attention is not as focused and learning is usually incidental. Ludic play in the DPF encompasses symbolic play or what Hutt described as 'imitative and dramatic play …associated with a greater degree of conceptual sophistication in the human' (pp. 247-248). In the DPF symbolic play occurs when the device, the tool is used deliberately in pretend play (e.g. use the iPad to record children's puppet show, which was created before the use of the device). Additionally, the element of innovation has been added in the DPF to signal the creation of pretend play deliberately for use of the device (e.g. children create a new puppet show in order to be recorded by the device, for further explanations of the framework see Table S1, Appendix A, adopted from Edwards & Bird, 2015, p. 7).

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According to Hutt (1971) children in the preschool age (3-5 years old) start with investigative activities when they encounter a novel object and after a while (less than 6 session of 10 min in her study) these activities decrease and playful activities start to take place or they can even be bored. The investigative activities last longer for younger children. Also, some pre-schoolers might not progress to playful activities and might be more intimidated by a 'novel object', especially when an adult is not present, Hutt called these children 'non-explorers' (pp. 244-246). Other theories (e.g. Klinger, 1971; Vygotsky, 1967) have argued that as children grow older exploratory behaviours decrease and children are playing within more structured games.

The DPF has only been implemented with a small number of children and though it is found to be a useful assessment and observational tool for educators when combined with more formative tools (e.g. photos, observation) the need for its wider implementation is imperative. According to the researchers, when children's behaviours are mapped on the DPF, educators can identify gaps, plan targeted activities and ways forward for children's learning. Similarly, in 2016, Marsh, Plowman, Yamada-Rice, Bishop and Scott, developed a detailed taxonomy, with 16 types of digital play based on Hughes' (2002) theory of play. However, for this study a decision was made to use the DPF as many Greek early childhood teachers have not used tablets with young children before and the DPF is simple, easy to understand and follow and could more readily assist teachers with their observations and assessments.

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The Greek context

In line with a socio-cultural perspective and the Vygotskian theory on play, this project adopted the 'digital play framework' developed by Bird and Edwards (2015) with permission to implement it in a Greek kindergarten (children 4–6 years). Digital tablets were introduced for the first time in this kindergarten and children had the opportunity to play with the them during free play time.

The most recent preschool framework, developed in 2011, reflects this educational focus and is divided into eight 'learning areas' (personal and social development; natural sciences; ICTs; environmental education; literacy; mathematics; physical development; and the arts). Play is recognised as an important way to learn for children at this age and different types of play are recommended and analysed e.g. socio-dramatic; imaginary; pedagogical or learning to use specific objects; play following specific rules; and exploratory play (pp. 27–28). Despite a clear emphasis on play in the first part of the framework, in the separate section about ICTs, there is no reference to play. In this section, the detailed aims of ICTs are explained and they are all connected with digital literacy and learning outcomes (e.g. learning to communicate, searching and discovering information, creating knowledge etc).

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Although the political and financial crises in Greece are widely known, investment in technology and in mobile devices is nevertheless growing rapidly (Eurostat, 2017). Significant work around the use of technology and how it supports certain learning areas such as mathematics and science (Kyriakides et al., 2016; Zaranis, Kalogiannakis, & Papadakis, 2013) has been completed, together with informative work on which apps are considered educational and how to evaluate them. However, this present study is the first and as yet the only one carried out in Greece with a specific focus on young children's free play and digital tablets.

Methodology

Research aims and questions

This exploratory study aimed to investigate the introduction and use of digital tablets by young children during free play. The digital play framework was the tool for observing children's digital play. The study's research questions were:

1) How do young children learn to use tablets during their free play time at kindergarten?
2) Is children's digital play changing with time and practice?
3) Is the digital play framework a suitable tool for observing children in a different cultural context?

Participants

This study was conducted in the 2nd and 3rd 'Experimental Kindergartens of Thessaloniki, the second largest city of Greece. Experimental kindergartens are public and function under the scientific supervision of a university. These kindergartens are supervised by the Department of Early Childhood Education of Aristotle University of Thessaloniki. A total of 16 children participated in this study (eight boys and eight girls). Children were randomly selected to participate and their mean age was 4.8 years (*SD* = 0.78).

Measures — Semi-structured observation scale

The semi-structured observation scale was developed based on the digital play framework (discussed above). Two types of children's object activities were evaluated: epistemic and ludic play. These were then analysed in terms of five behaviors (e.g. exploration, problem solving etc), described by 13 indicators and descriptions of children's actions (e.g. exploring the operating functions of the device).

Procedure

Two early childhood teachers from the Experimental kindergartens conducted the observations and recorded the videos. Data were collected from March until June 2017. During these four months,

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children used the tablets in pairs or small groups during free play for approximately one hour per week. A total of ten observations in ten different weeks were conducted. Six of the paired free play sessions were observed with the semi-structured observation scale (2nd, 3rd, 5th, 6th, 7th and 9th weeks) and four of the paired free play sessions were recorded (1st, 4th, 8th and 10th weeks). Each observation lasted approximately 30 minutes. A total of 960 minutes has been video recorded.

Two types of applications were used. The first were pre-installed and included letter and number recognition tasks, matching numbers or words with objects, listening to stories, using the camera to take photos or videos, and drawing. Other apps were installed by the teachers, for example 'Flow Free' (matching colors puzzle), 'Cut the rope' (STEM problem solving), and 'Tux Paint' applications. Ethical approval was granted by the university. Teachers informed their school counselor and the parents about the aim, rationale and content of the project, and all relevant consent forms were completed.

Results

a) Written observations

The written observations were carefully read and deductively analysed based on the digital play framework's objects of activity, behaviours and examples (Table S3). They were coded twice for each child by two researchers to ensure validity and consistency. The examples for each behaviour were clearly described in the original framework and were very useful in the analysis of the observations. The Greek children demonstrated a range of these behaviours with very similar examples some of which are presented in Table 1 for epistemic play.

Table 1: Similarity of behaviours/examples in the two cultural contexts

Object of activity	Behaviours	All devices	Description of activities	Coded example — Australia	Coded example Greece —
Epistemic	Exploration	Seemingly random use of the device	Seemingly random footage, images, pressing the iPad	R. films the ground and someone's legs	H. accidentally presses the camera button and starts taking photos of S
		Locating/exploring the operating functions of the device	Locating the on/off button (video camera); shutter button (still camera); home button	R. learns to zoom in and out on the flip camera and practises	H. learns where the draw app is and uses the different colours to colour the picture
		Following directions from the device or other people/Asks — seeking assistance for desired outcome	Following directions from the device or other people/Asking adults or peers for assistance with the device.	R. asks why the numbers on the flip camera are changing	H. asks the teacher to help her unlock the tablet — the teacher reminds her of the code and H. presses the numbers

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Overall, more children exhibited epistemic play, going through all the different behaviours in weeks two to six. This progression of behaviours was not identical for all children. For example, all children started with the 'exploration' phase in their epistemic play in week two, focusing on how the tablet was working, but some also exhibited the same behaviour in week six, depending on the app they were using, and if they had not used it before. As can be seen from Table 2 epistemic play was evident throughout the observations, even in the final weeks for most children, providing evidence of a more cyclic nature of the framework, where exploration starts again as a new 'object' is discovered. The 'new object' could be an app, or a new 'function' of the tablet that children discovered. So, even though the tool was the same (the tablet) children's exploration was reinvigorated by new apps or games. Children had to go over the 'exploration' phase before engaging in ludic play. For example, they had to explore the camera operations before actually using the camera for symbolic and innovative play.

Table 2: Written observations: number of children in each object of activity

Object of activity	Behaviours	Total *N*	Weeks 2-3 *N*	Weeks 5–6 *N*	Weeks 7–9 *N*
Epistemic		16*	16	16	14 (7 boys/7girls)
Ludic	Symbolic	10* (5 boys/5 girls)		2	10
	Innovation	4* (3 boys/1 girl)			4

**The number is not a sum of children*

The majority of the children reached ludic play, mainly the 'symbolic' behaviour ('deliberate use of device for pretend play') while four reached 'innovation' behaviour ('creating pretend play deliberately for use of the device'). Interestingly, in the 'innovation' object activity there were more boys represented and this activity was obvious later in the project, especially during the final weeks (7–9).

Most of the children spent six to seven weeks playing with the tablets before exhibiting ludic play. They spent almost six hours of playing with their pair on the tablet before demonstrating the more advanced forms of play. It took around six hours of shared play with a digital device before the children could work out the technical issues and acquire the necessary skills to be able to use the technology in a more symbolic, innovative and creative way.

All the examples of ludic play found in the analysis of the written observations are presented in (Table S2 - Appendix B). It is obvious that the children were very interested in taking photos and videos of

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themselves, their friends and also their school. They became 'young directors' and were even able to give instructions and reflect on their creations by revisiting their videos. It should also be noted that there was no assistance from the teachers at any stage. The children helped themselves and each other. Arguments or fights were very rare. The teachers observed that the children were able to follow exact instructions from their peers and also remember these instructions after several weeks.

b) Video-recorded observations

Following the investigation of the written observations, the fourth video-recorded observation for each pair was analysed using the framework. The fourth video for each pair (week 7 to 9) was chosen as the one most probable to have instances of children's ludic play (symbolic and innovation). Significantly, although the progression of children's play was not linear, ludic play was only observed in the final weeks of the project. Thus, analysis of the final videos was prioritised. The rest of the videos will form the basis for future important analysis.

Out of the four video-recorded observations, we found two indicative videos with a pair of children who reached ludic play. These provide useful examples of how the tablet was shared among children and became an integrated part of their play. The two vignettes presented below and accompanying photos are indicative of this symbolic and innovative play from the final weeks of the project.

Vignette 1: *Ludic — symbolic play* (30 May 2017):

Maria and George (pseudonyms) want to record a video of a puppet show the rest of the children are preparing.

Start: 1.03 pm

It is time for Maria and George to use the tablets. The rest of the children ask Maria and George whether they would like to video them while they are playing with the puppet theatre. George replies that they would like to play with the tablet first. After a few minutes, George asks Maria if they could go and record the other children playing with the puppet theatre. Maria stands up holding the tablet in her hands is such a way as to record what is happening in front of them. George holds her hand to help her and they move towards the rest of the children (figure 1). A few children are behind the puppet theatre and they move their puppets so Maria can take photos.

Maria says, repeatedly: 'start the show, we do not want just photos'. George also tells the children to start their show. They are all laughing. George and Maria give them instructions while also looking at the tablet and recording everything (figure 2). The children throw down the puppets and George picks them up. There is no story, just a random movement of the puppets and some jokes. Maria keeps recording and George helps her (figure 3).

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After almost five minutes, Maria goes back to the couch with the tablet in her hands and George goes with her. They want to watch what they have recorded. The rest of the children follow them. George tells Maria what to click so they can watch their video. They spend a lot of time commenting on the video and reflecting on what happened. George comments: 'we have recorded everything … everything'. They try to recognise different children's voices without seeing their faces and they try to remember what exactly happened (figure 5). They watch the video twice although their teacher tells them it is lunchtime. The second time they watch the video they laugh a lot, they move backwards and forward through the recording trying to locate the exact moments they want to watch. They also make suggestions about the future; for example, George says to Maria that she keeps on saying the same thing and Maria replies: 'I won't say this again'. At the end, when they turn off the tablet, they go to their friends and say: 'your show was nice….we watched it (laughing)'.

Finish: 1.32 pm



Figure 1: Maria and George move towards the puppet theatre.

George helps Maria, holding her hand so that the video recording is good.



Figure 2: George and Maria record together the puppet show together.

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Figure 3: The children start their show after encouragement and instructions from Maria and George.



Figure 4: George and Maria work together, giving instructions for the puppet show.

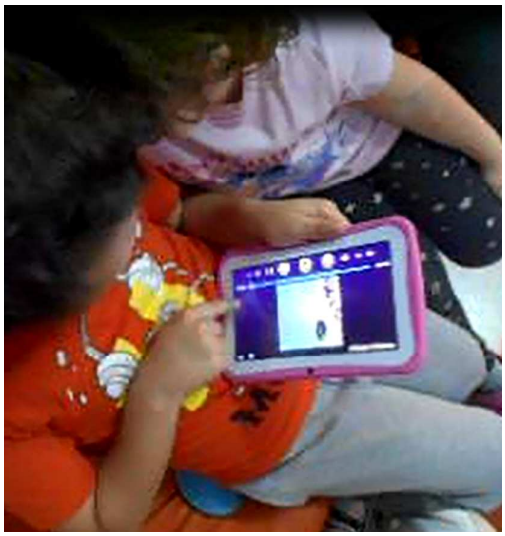


Figure 5: George and Maria watch the video they recorded.

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Vignette 2: *Ludic — innovative play* (1 June 2017):

Dimitris and Katerina (pseudonyms used) have the tablet outside. The other children organise running races and Katerina uses the tablet to record them.

Start: 10.21 am

Ten children are outside in the courtyard. It is Katerina's turn to use the tablet after Dimitris has played with different apps. Her friends suggest she take a video of their race (four children, two boys and two girls). Katerina agrees but asks for help on locating the video button. Another girl helps her. Katerina then starts to record the race with the tablet (figure 6). The first race does not go according to plan so the children want to do it again. Katerina pauses the video and waits until they are ready again. The second race starts and Katerina follows the children with the tablet in her hands. She does not say anything but she is very careful with the tablet, making sure everyone/everything is recorded. She even runs with the other children so she can capture everything. The second race finishes and one girl loses. Katerina comments to her friend who lost: 'I was recording it'. One of the boys asks her to record a third race. Katerina says: 'I will try'. One of the boys starts the third race before all the children have gathered so the rest of the children are upset. They shout at him and tell him to come back. He returns. The children argue for a moment — Katerina does not intervene, as she is concentrating on the tablet. Katerina restarts the video capture. She gives the children instructions when to start. Holding the tablet in front of her she shouts: 'three, two, one…go'. The race is repeated several times. Katerina is not sure whether the video is working so asks for help. The other children gather around her and help her. Then they start another race. One of the girls cheats and Katerina tells her: 'you are cheating…I am not recording you…no way'. Katerina leaves and goes closer to the rest of the children. The girl who was accused of cheating does not say anything. Katerina continues to hold the tablet and record the other children. The teacher asks Katerina whether she has saved the video. Katerina says she is not sure whether she has actually recorded the race!

The children gather around Katerina to watch the videos but realise that Katerina has not recorded videos. Instead, she has just taken photos. They all laugh. No one complains and no one says anything against Katerina. Katerina gives the tablet to Dimitris and starts racing with the other children. Dimitris records the races and then watches the video. Katerina comes back takes the tablet for a minute and then gives it to another boy. The boy walks around and records the races, making comments as if he is describing a real race on TV, (for example, 'Katerina is first, Dimitris is second but now he is closer to Katerina…'). The tablet goes from one child to the another without any arguments. At one point in time (figure 9), one boy holds the tablet while a boy next to him gives a description of the race. The children keep on competing. Katerina takes the tablet again and turns around towards the wall where the finish line is. She points the tablet towards the wall and waits for the winner (figure 10).

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Finish: 10.56 am.



Figure 6: Katerina starts to record children's race.



Photo 7: Katerina runs with the other children in her attempt to record the race.



Figure 8: The children help Katerina to restart the video.

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Figure 9: Other children record the races and describe them.

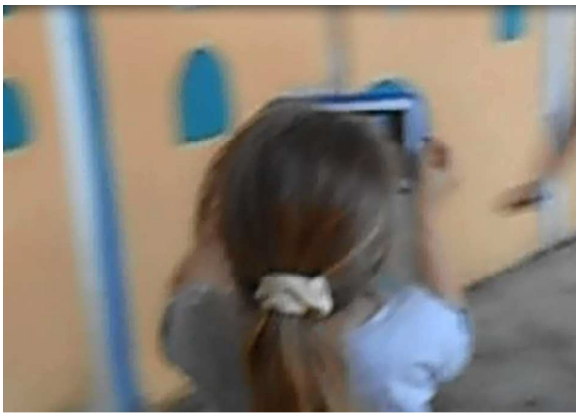


Figure 10: Katerina waits for children to finish the race, looking at the finish line.

Discussion

This Greek study focused on the use of one digital device (tablet) during children's free play, and used a framework from a different culture (translated into Greek). Findings from the study offer useful insights into how children learn to use digital devices. In line with Hutt's theory and the Australian implementation of the DPF, children first explored the functions, technical characteristics and operations of the device (epistemic play). With almost no help or scaffolding from the teacher, all of children involved in this study were able to solve problems and acquire the skills to operate the device and also to play with a range of different apps. Advantages gained from using tablets were evident, for example, motivation, enthusiasm, co-operation, portability, lower cost, and variety of applications.

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Many of the children entered ludic play after six hours of shared exploration. Symbolic and Innovative play are associated with more advanced mental skills and knowledge (Leontiev, 1981; Vygotsky, 1978; 2016). The children were able to 'own' the device and use it for their own purposes. They recorded videos and took photos of their own play as well as their friends' endeavours. A new technological dimension was added to their play. Technology was immersed in their play, making it more interesting but also more social and co-operative. Significantly, the device was not transformed into something else. It was not changed into an imaginary object as children often do in pretend or symbolic play, but rather was adjusted to the children's social reality. The device was used as a medium to document important achievements, and became a social and cultural artefact of the preschool room (Vygotsky, 1978; 2016). This finding, together with the findings from the Australian DPF study, challenge Hutt's theory. How can a 'novel object' be immersed in children's everyday play? Tablets, as 'novel objects', have characteristics (e.g. portability and interactivity) which were not possible back when Hutt was implementing her pioneering experiments.

In line with previous investigations from Fleer (2014) and Arnott (2016), the children's play became more complex and reflective. The first vignette demonstrated that the children not only used the device for recording their friends' show, but were also in a position to 'direct' the show so that it was recorded successfully. They revisited the videos to make sure they improved their skills (their own and their peers'). They improved not only the puppet show but also the way they used the tablet to record it. These reflective thoughts were a positive surprise. Though not analysed in Hutt's theory, previous research with older children has documented that technology could support metacognitive and reflective skills (Plowman, 2016; Yelland & Gilbert, 2013). Our findings extend these claims for younger children, although more research is imperative in this field.

After only six hours of using the tablets, children made them a seamless part of their play. The second vignette showed how the children were able to incorporate the device into their physical play outside. The race only started when the tablet was ready to record it. The tablet was also used to examine fairness, to determine the outcome of the race and to see whether children were cheating. The tablet was also used to describe and comment (literacy, creativity) on the race, taking examples from other media (e.g. TV commentators). Finally, it is very important to note that the device did not isolate any of the children, it was used by them all without any arguments. Here using technology was clearly not the opposite of physical activity. The girl was able to hold the tablet, run, and at the same time record her friends. Physical, social, technical and creative skills were all tied together and we were able to witness children's development holistically and not in separate domains. This is consistent with socio-cultural theories and how Vygotsky (1978) explains the power of play: 'play contains ….all developmental tendencies' (p. 74).

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Overall, the use of the framework in a different cultural context was successful and no issues were raised. The teachers found it easy to understand and follow in their observations. Our suggestion would be to add a few more behaviours, such as 'advanced exploration' or 're-exploration' before or as the first phase of ludic play and 'reflection' as an additional behaviour after 'innovation'. In addition, the framework could perhaps take a circular shape to demonstrate its cyclic nature (see figure 11-S3 in Appendix); children's progress is not linear and they move back and forth in their engagement with technology. These suggestions, however, need more substantial theoretical work, which is beyond the scope of this paper and larger samples to provide more robust evidence.

Significantly, the majority of children in the study were able to reach ludic-symbolic play but not the innovation stage of ludic play and this is an area for further examination. Power relations, personality traits, demographics, the quality of apps, time constraints, teachers' role, home access and other reasons may have a decisive role in children's progression. Hutt reported that some children were found to be 'non-explorers' or bored easily. She also underlined the significant role of teachers in making children feel more confident around 'novelty' (p. 243). Though we did not observe boredom or 'non-explorers' in our study at any stage, it did take a while for children to exhibit more advanced forms of play and Vygotskian perspectives on how experienced adults, parents and teachers, could provide more time for experimentation and scaffold this process for young children would be worth investigating in future studies, as also suggested in the Australian implementation of the DPF (2015, p. 13).

This study contributes to the field of digital play by providing rich insights on how new devices can be integrated in children's free play. It also reinforces the evidence that technology is not a threat to play. However, more work is necessary to examine how children can be scaffolded so that they can use technology in creative, innovative and reflective ways in their play. Further, this study was conducted in a large city, at a high quality kindergarten, and the outcomes could have been very different in the context of regional areas of Greece (Eurostat, 2017).

Conclusion

Most of our children are motivated, engaged, enthusiastic and eager to explore anything new, to experiment and be adventurous without worrying about impacts, definitions and categorisations. As Montessori noted, play is their work and our work is to facilitate play and exploration for them in any way possible, providing them with plenty of time to experiment, collaborating with parents, being critical but open-minded and not resistant to change. Technology will continue to evolve and the types and nature of children's play will also keep on changing, but children will continue to love playing, to learn and grow from play and this is their undeniable right.

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Statements on open data, ethics and conflict of interest

Data from written/video recorded observations are available for review. Authors will retain data for five years as per University guidelines. Permission to access the data can be provided by emailing the authors. Details on ethics are provided in the text and abide by the Aristotle University Ethical Guidelines. Pseudonyms have been used throughout the paper to ensure confidentiality and anonymity. Photos (figures) have been included with permission and children's faces are covered. No conflict of interest to declare.

References

Arnott, L. (2016). An ecological exploration of young children's digital play: framing children's social experiences with technologies in early childhood. *Early Years, 36*(3), 271–288. doi:10.1080/09575146.2016.1181049

Aubrey, C., & Dahl, S. (2013). The confidence and competence in information and communication technologies of practitioners, parents and young children in the Early Years Foundation Stage. *Early Years, 34*(1), 94–108. doi: 10.1080/09575146.2013.792789

Bird, J., & Edwards, S. (2015). Children learning to use technologies through play: A digital play framework. *British Journal of Educational Technology, 46*(6), 1149–1160. doi:10.1111/bjet.12191

Edwards, S., & Bird, J. (2015). Observing and assessing young children's digital play in the early years: Using the Digital Play Framework. *Journal of Early Childhood Research, 15*(2), 158–173. doi:10.1177/1476718x15579746

Eurostat (2017). Science, technology and digital society statistics introduced. Accessed 10 December 2017 from http://ec.europa.eu/eurostat/statistics-explained/index.php/Science,_technology_and_digital_society_statistics_introduced

Fleer, M. (2014). The demands and motives afforded through digital play in early childhood activity settings. *Learning, Culture and Social Interaction*, *3*(3), 202–209. doi :https://doi.org/10.1016/j.lcsi.2014.02.012

Hughes, B. (2002). *A playworker's taxonomy of play types* (2nd ed.). London: PlayLink.

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Hutt, C. (1971) Exploration and play in children. In R. E. Herron & B. Sutton-Smith (Eds.) *Child's Play* (pp. 233-251). New York: John Wiley.

Hutt, S., Tyler, C., Hutt, C., & Christopherson, H. (1989). *Play, exploration and learning. A natural history of the preschool.* London, UK: Routledge.

Klinger, E. (1971). *Structure and Functions of Fantasy*. New York: Wiley.

Kyriakides, A. O., Meletiou-Mavrotheris, M., & Prodromou, T. (2016). Mobile technologies in the service of students' learning of mathematics: The example of game application ALEX in the context of a primary school in Cyprus. *Mathematics Education Research Journal*, *28*(1), 53e78.

Leontiev, A. N. (1981). *Problems of the development of the mind*. Moscow: Progress Publishers.

Marsh, J. (2010). Young children's play in online virtual worlds. *Journal of Early Childhood Research*, *8*(1), 23–39. doi: 10.1177/1476718x09345406

Marsh, J., Plowman, L., Yamada-Rice, D., Bishop, J., & Scott, F. (2016). Digital play: A new classification. *Early Years, 36*(3), 242–253. doi:10.1080/09575146.2016.1167675

Merchant, G. (2015). Keep taking the tablets: iPads, story apps and early literacy. *Australian Journal of Language and Literacy, 38*(1), 3-11.

Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2016). Comparing tablets and PCs in teaching mathematics: An attempt to improve mathematics competence in early childhood education. *Preschool Primary Education*, *4*(2), 241–253.

Plowman, L. (2016). Learning technology at home and preschool. In N. Rusby & D. Surry (Eds.) *Wiley Handbook of Learning Technology* (pp. 96–112). Chichester: Wiley.

Shifflet, R., Toledo, C., & Mattoon, C. (2012). Touch tablet surprises: A preschool teacher's story. *YC Young Children*, *67*(3), 36.

Verenikina, I., Kervin, L., Rivera, M. C., & Lidbetter, A. (2016). Digital play: Exploring young children's perspectives on applications designed for preschoolers. *Global Studies of Childhood*, *6*(4), 388–399.

Vygotsky, L. S. (2016). Play and its role in the mental development of the child (with Introduction and Afterword N. Veresov and M. Barss, Trans.). *International Research in Early Childhood Education*, *7*(2), 3-25.

Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Wohlwend, K. E. (2015). One screen, many fingers: Young children's collaborative literacy play with digital puppetry apps and touchscreen technologies. *Theory Into Practice*, *54*(2), 154–162.

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Yelland, N (2011) Reconceptualising play and learning in the lives of young children. *Australasian Journal of Early Childhood*, *36*(2), 4–12.

Yelland, N., & Gilbert, C. (2013). I-possibilities: Tablets in Early Childhood Contexts. *Hong Kong Journal of Early Childhood, 12*(1), 5–14.

Zaranis, N., Kalogiannakis, M., & Papadakis, S. (2013). Using mobile devices for teaching realistic mathematics in kindergarten education. *Creative Education*, *4*(7), 1-10. doi:10.4236/ce.2013.47A1001

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APPENDIX A

Table S1: The Digital Play Framework (Edwards & Bird, 2015, p. 7).

Digital technologies-as-tool

Object of Activity (from Hutt, Tyler, Hutt & Christopherson, 1989)	**Behaviours**	**Indicators**	**Description**
Epistemic play	Exploration	Seemingly random use of the device	Seemingly random footage, images, pressing the iPad, moving or clicking the mouse
		Locating the operating functions of the device	Locating the on/off button (video camera), shutter button (still camera), home button (iPad), keyboard (computer) or mouse (computer)
		Exploring the operating functions of the device	Exploring the on/off button (video camera), shutter button (still camera), home button (iPad), keyboard (computer) or mouse (computer)
		Following directions of the device or other people	Following the directions of the device or other people
		Seeking assistance for desired outcome	Asking adults or peers for assistance to use the device
	Problem solving	Relating actions to the response/function	Pressing the on/off button, relating turning the camera to what is in the viewfinder (video camera), pressing the shutter button, relating turning the camera to what is in the viewfinder, pressing the Home button to change Apps, scrolling through Apps (iPad), relating mouse and keyboard to actions on the screen (computer)
		Trying different actions to solve an issue	Returning to the menu button; asking peers or adults for advice/help
		Intentional use of the operating functions	Selecting record functions to create footage
	Skill acquisition	Intentional and deliberate use of functions for desired outcome	Being able to view taken footage (video camera) or images (still camera), scrolling and tilting (iPad), using mouse to move cursor, click and double click program icons (computer)
		Sharing learned actions with others	Being able to share knowledge of functions of the device with others for the purpose of teaching others (ZPD)
		Intentional and controlled footage of observable people, events and situations or manipulating the app or program for own purpose	Creating and filming deliberate play scenarios
Ludic play	Symbolic	Deliberate use of device for pretend play	Using the device to record already established pretend play or to record re-enacted play (video and still cameras), selecting an App specifically for pretend play (iPad), selecting a program specifically for pretend play (computer)
	Innovation	Creating pretend play deliberately for use of	Creating a pretend play to record (video or still cameras), selecting an App specifically for

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	the device	pretend play (iPad), selecting a program specifically for pretend play (computer)

Source: From Edwards & Bird, 2015, p. 7.

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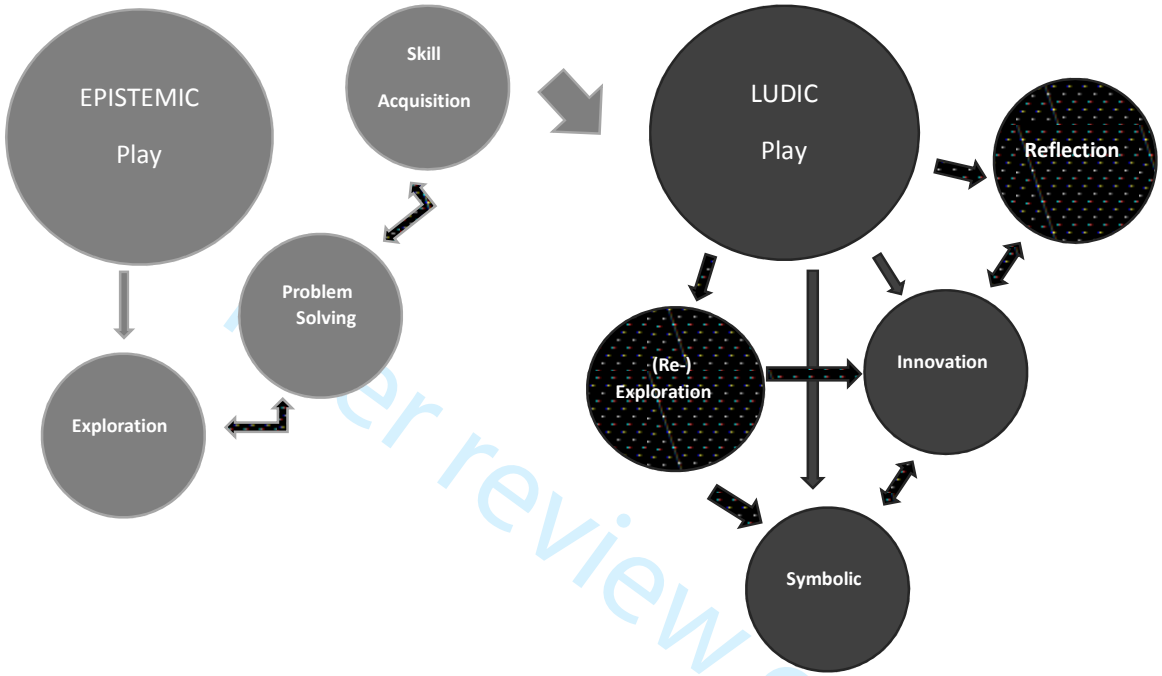
Table S2: Examples from all pairs coded as 'ludic play'

Object of activity	Behaviours	Pair 1 John and Sue: Week 6	Pair 2 Kay and Tim: Week 9	Pair 3 Sam and Noe: Week 7	Pair 4 Hope and Elly: Weeks 7, 9	Pair 5 Mike and Ava: Week 7
Ludic	**Symbolic**	Sue asks John to record her karate moves. They both watch the video afterwards. Then they record other children who make puzzles. They stop recording and watch the video, making suggestions on how to improve it (e.g. stand on the chair)	Tim asks Kay if she wants her photo taken while playing at the puppet theatre (Kay was taking photos of other children before that). Kay says yes and Tim takes the photos. After a while Tim says to Kay that is now her turn to take photos of him. This is ongoing and children keep changing roles.	Sam suggests taking the tablet outside. Other children gather around them. Sam asks Noe to take a photo of a 'weird worm' on the ground. He does and then they continue to take photos of 'unusual' objects and living creatures that they find outside. Later, Sam asks Noe to take her photo. She even gives him instructions (as if she is a director): 'wait Noe, take a step back…wait…don't move the camera'.	Hope clicks on camera by accident and takes a photo of Elly's feet. Elly makes a funny face and Hope takes another photo (Elly's funny face). Hope shows Elly the photo. Elly asks for the tablet. Elly asks Hope to make a funny face take a photo. Then they start a different application. The two girls repeat the same activity as described above in week 7 and after taking photos of each other, they start taking photos of the room. They then watch the photos and they make comments (e.g. Hope says: 'this one is blur').	Mike takes the tablet outside to take photos of the old playground as the class is preparing a complaint letter for the Mayor. Mike uses the zoom in and out button. When he finishes he returns to class and realises that he has taken a video and not photos. He starts over, going out again to take the photos.
	Innovation	**Pair 1: Jo and Sue – Week 7** The pair take the tablet and Sue immediately tells John to click on the camera. He does. John asks Sue if he can make a video of her. Sue says 'no, I will record you'. John agrees and stands in front of her. Sue gives him instructions: 'John do something. I am recording you'. John makes funny faces. Sue then opens the video library so they can watch what they have recorded. They watch the video and John suggests adding music. He clicks on the sound icon but nothing happens. They just watch the video again.			**Pair 5: Mike and Ava – Week 9** Mike and Ava are playing with an app where they have to win points in order to change levels. They use different strategies and then a third friend comes to help them. They listen to him and they are successful. They laugh and cheer with their success. They take the tablet outside and other children gather around them. George and Dim tell them how to be careful with the app. They listen to this advice and win again, changing another level. Mike makes comment about the current level and how their previous efforts helped them unlock the tokens for this level. After a while, the teacher tells them that the time is up. Mike asks the teacher for some more time. He wants take photos of the children playing in the playground. The teachers says yes and Mike finds the photo button then takes the tablet outside to take photos.	

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Note: The shapes with the dots are the suggestions.

Figure 11 – S3: A revision of the Digital Play Framework (adapted from Birds and Edwards, 2015).

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