1-1-2014

Generation alpha at the intersection of technology, play and motivation

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Keywords

intersection, technology, motivation, alpha, generation, play

Disciplines

Engineering | Science and Technology Studies

Publication Details

Tootell, H., Freeman, M. & Freeman, A. (2014). Generation alpha at the intersection of technology, play and motivation. In R. H. Sprague Jr (Eds.), 47th Hawaii International Conference on System Sciences (HICSS) (pp. 82-90). United States: The Institute of Electrical and Electronics Engineers Inc.

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This paper considers the intersection of technology and play through the novel approach of gamification and its application to early years education. The intrinsic connection between play and technology is becoming increasingly significant in early years education. By creating an awareness of the early years adoption of technology into guiding frameworks, and then exploring the makeup of gaming elements, this paper draws connections for guiding principles in adopting more technology-focused play opportunities for Generation Alpha.

1. Introduction

This paper provides an insight into the applicability of gamification to early childhood education (ECE). It is timely research given the increasing popularity of gamification throughout other schooling levels and business. At a time when technology is becoming more embedded in the ECE environment, this paper is designed to get those involved in ECE to carefully examine their underlying desires to embed gamification into the curriculum.

2. Who are Generation Alpha

Generation Alpha is far from being a household name to describe the new wave of world inhabitants, but it is one of the terms being used to describe those being born at the cross-over of Generation Z and the new age.

What is most important about this generation is the digital environment they are being born into. Technology is a part of their everyday lives, influenced by parents, educators and many other social interactions. The concept of "connection" is central to this generation, even more so than their predecessors Generation Z [1]. Another term used to describe this generation comes from the nickname "digital natives". Bennett [2] refers to "digital natives" based on the definition provided by Prensky [3], who perceives "students today [as] all "native speakers" of the digital language of computers, video games and the Internet". Bennett considers the digital natives to be those with a native possession of sophisticated knowledge of and skills with information technologies, that are particularly different to those from earlier generations. These differences are felt most strongly in educational expectations and experiences, however Bennett et. al. [2] profess a wariness to making revolutionary change. Instead they suggest that the changes can be considered evolutionary, in which case, this paper reflects on the changes being made from multiple perspectives in the early years space to provide a considered and objective view of the intersection of technology, play and motivation.

3. Early years national frameworks and technology

The adoption of technology in early childhood education (ECE) is of international interest. Technology in education is prompted by the United Nations Educational Scientific and Cultural Organisation (UNESCO) as a way of addressing "access, inclusion and quality" [4]. This is being addressed by many countries as they move to integrate technology-specific guidelines in the various national education frameworks. The following is a list of major countries who are adopting information and communication technology (ICT) in this space: ICT is a key element in the new Australian National Curriculum [5], the United States' National Association for the Education of Young Children 'Technology and Interactive Media as Tools in Early Childhood Programs' policy statement [6], and the United Kingdom's National Curriculum [7].

In the Early Childhood Education (ECE) field, Turja et. al. [8] believes that the guidelines for

technology education in curricula are mostly very general, or fragmented, or missing altogether. By expounding the focus on technology in curriculum documents, they believe that greater focus can be afforded to its integration.

In the Australian context, the Early Years Learning Framework explicitly ties two learning outcomes to technology. Outcome 4: Children are confident and involved learners, states that children should have "access to technology". Outcome 5: Children are effective communicators, states that "technology should be child friendly" [9].

Te Whariki, which guides New Zealand ECE, identifies technology as a component of early literacy goals. The literacy outcome related to technology use states: "Children develop: experience with some of the technology and resources for mathematics, reading, and writing" [10, 11].

The UK Early Years Foundation Stages curriculum clearly documents the role of technology. In the learning objective of Understanding the World: Technology, "children recognise that a range of technology is used in places such as homes and schools. They select and use technology for particular purposes". In the learning objective of Expressive Arts and Design: Being Imaginative, "children use what they have learnt about media and materials in original ways, thinking about uses and purposes. They represent their own ideas, thoughts and feelings through design and technology, art, music, dance, role-play and stories" [12].

The use of technology within ECE in the United States is guided by a position statement by the National Association for the Education of Young Children and the Fred Rogers Center [6]. This position statement considers positive and negative influences of introducing technology into ECE curriculum. The position presented is that "Technology and interactive media are tools that can promote effective learning and development when they are used intentionally by early childhood educators, within the framework of developmentally appropriate practice [13], to support learning goals established for individual children" [6].

4. Play

A child's overall development and well-being is strongly shaped by their involvement in play. It is recognized as a contributor to a child's social, personal, linguistic, physical, cognitive, moral, creative and artistic development [14]. Farné [15] believes that although play continues throughout the human life cycle, it is during childhood that play has a "specific and deep educational role". Play as a means of learning can be classified in three different ways: child-directed play, teacher-directed, and mutually-directed play. Historically, early childhood curriculum has associated play with child-centred pedagogy [16], however in recent years there are a number of other perspectives that are being drawn in, including the importance of teacher interactions in play-based activities, and the significance of the nature of the dynamic relationship between children (learners) teachers and content [17, 18]. This perspective is particularly significant as increased use of technology pervades the ECE experience.

A firm definition of play in the context of early childhood education is difficult to find [19, 20], however there are some descriptors commonly used:

- Active, exploratory
- Intrinsically motivated
- Carried out 'as if'
- More focused on process than on product, and
- Relatively free of external rules yet reflecting experiences and contexts [21].

Fleer [19] believes that the breadth of contributing theories to childhood play result in most childhood activities and behaviors being able to be described as 'play'. A consequence of there being no firm definition is that 'play' can sometimes be caught up in political deliberations. For example, the OECD has avoided the term 'play' and instead has referred to "the child's agency and natural learning strategies" [21, 22]. Vygotsky's 1966 theory of the role of play in the mental development of children provides directions for re-thinking how we have conceptualized play [19]. His theory of play recognizes the significance of language development in play, and observed that children at play are in a constant process of "inner speech" in order to make sense of the world around them. The idea of scaffolding in Vygotsky's theory, known as the "zone of proximal development", occurs in the differential between a child playing alone, and the child's experiences when assisted by either another child or an adult [23]. The role of technology as a scaffold has influence here.

4.1 The influence of technology on play

Recently there has been a change in the paradigm of computing device user interfaces, in particular how users provide input to these devices. This new form of interaction is known as a gestural, or natural interface [6] and involves the user providing input to the device by using their fingers to create single and

multiple touch gestures on the screen. Computing devices that utilise a gestural user interface include Interactive Whiteboards, iPads and other tablet devices.

The ability for the integration of gamification elements into learning experiences has been enhanced by the increased availability of these natural user interface technologies [24]. Although there is this widespread availability of these technologies, the need for appropriate educator training to maximize the usefulness of the devices has been highlighted in prior literature [25-28]. This presents a challenge for both educators and educational institutions. This issue highlights a key issue in the complexity of embedding gamification in teaching and learning experiences. A clear understanding of the concept of gamification is therefore essential for educators as they seek to connect more closely with learners and provide them with learning experiences that are aligned with future career opportunities.

5. Motivation through technology

Technology use in education is not new. There have been many instances of technology-based games used to engage students at various skill levels. Some popular examples from the 1980s include: Carmen Sandiego, Mavis Beacon Teaches Typing and Math Blaster. In the 1990s, Civilization and RollerCoaster Tycoon encouraged planning and management skills. In 2002, the Serious Games Initiative was established with the goals of helping to organize and accelerate the adoption of computer games for a variety of challenges facing the world today [29].

However, simply adopting a game, either technology or non-technology based, to teach a particular skill or set of skills, is not at the heart of gamification. Miller [30] distinguishes between the two to suggest that game-based learning can be a small component of the learning, whereas gamification refers to changing the entire model of instruction to be a game or game-like.

5.1 Gamification

The practice of gamification has recently gained prominence and been disseminated across many contexts. Gamified practices have been integrated into enterprises, health, marketing and education; this process is also referred to as utilizing game mechanics in operations. These practices have achieved varying levels of success and acceptance across different industries. Typical implementations have involved the use of IS, providing employees with intrinsic rewards for completing tasks. Despite increasingly widespread discussion on the topic with broad agreement on many key aspects of the concept, a single working definition of gamification has not been agreed by either researchers or practitioners [31]. Kapp's [32] understanding of gamification focuses on a variety of actions to engage, motivate, promote and solve problems. His basis is using game-based mechanics, aesthetics and game thinking to engage people. Within the educational context, definitions of gamification vary [33]. Muntean [33] argues that gamification is not about the process of creating games; it is focused on making learning fun and engaging while ensuring the integrity of the learning experience. The main area of agreement is the importance of embedding the gaming characteristics in the context of learning [31]. Ultimately by employing gamification into any environment, be it commercial or educational, the focus should be about making the overall experience more engaging, thereby motivating the employee or the learner to achieve.

5.2 Intrinsic Motivation

If we consider gaming concepts from a theoretical perspective, Malone and Lepper's 'Taxonomy of Intrinsic Motivations' [34] is of benefit for developing deeper understanding of the rationale behind playing games. This taxonomy is divided into two sections: individual motivations and interpersonal motivations. Individual motivations are centered on challenge, curiosity, control and fantasy. Each of these elements can play a key role in the player's experience; when they are introduced appropriately to non-gaming environments there is potential for increased motivation. The second section of the taxonomy, interpersonal motivations, includes cooperation, competition and recognition. Once again these are all potential elements available to increase a user's experience of a system.

As games become more advanced, a greater number of gaming concepts can be employed to increase the motivations of players. The following is a list of gaming concepts that can be included in a game.

Engagement (including conflict, competition or cooperation): When a contest with the system or with other players occurs, a game embodies elements of engagement and acts as an interpersonal motivator [32-36].

Investment: A player becomes invested in the experience through their engagement with a game.

This investment means that players continue to play the game to achieve the game's created goals [32, 33].

Fulfillment: A sense of fulfillment can be achieved through engagement in a controlled setting such as a game. This opportunity also provides players with opportunities to take risks [37].

Abstractions of concepts and reality: For a game to function effectively, it must be established at a level that represents an abstraction of society; mundane concepts are removed to increase player engagement [32, 33].

Reward structures: Through the achievement of both goals and sub-goals in a game, rewards can be delivered to a player through internal/individual, intrinsic or extrinsic means [32, 33]. Often reward structures are linked to individual motivations [34]. Examples can include being listed on a high score board and achievements/badges; in practice Apple's 'Game Center' is a real-world example of this. showing both leaderboards and achievements of Apple device applications.

Progression, levels: Progression through game levels indicates the ability a player has in some gaming environment. The completion of each level is usually reflected as the achievement of a sub-goal [32, 33].

Storytelling: The element of storytelling is a feature of the most compelling games. The story can be embedded in the flow of the game; when a game is played all players participate in the story told in the game [32, 37].

Curve of interest: For players to be motivated into actually playing the game it must be an engaging experience. This is usually achieved through sub-goals. A game should incorporate peaks and troughs to engage the player and to establishment and maintain interest [32, 37].

Replay, do-over or infinite play: A game allows a player to attempt activities a number of times to achieve sub-goals and goals if unsuccessful the first time. This is a key advantage over real world experiences [32]. This gaming concept allows a player the freedom to fail in something that typically has consequences in real-world environments.

Actions, Events: Actions are the ways that a player makes changes to the state of the game [38], achieved through the manipulation of objects. Events are the outputs from actions performed during game play [38]. These concepts are both temporal elements of game play.

Game state: Bjork and Holopainen [38] identified three elements of a game's state: game instance, game session and play session. A game instance refers to the components, action and events that describe a single play of a game. Game session is how each player interacts with the game. In a one player game, the game instance equals the game session. Where there are multiple players, each player has a different game session based on their interactions with the game. A play session is the period of time that a player engages with the game in one sitting. For some complex games, an individual game instance may occur across several sessions.

As identified earlier, not all of the gaming concepts need to be present in all gamified experiences.

5.3 Significance to early years

Knewton's [39] 'The Gamification of Education' Infographic, which has initiated much discussion about the role and value of gamification in education, included a list of 'elements of gaming [that we can] harness for educational purposes'. The following section draws together the approach of Knewton and gaming concepts described in the previous section. The following analysis considers the appropriateness of the identified characteristics for use in ECE.

Progression refers to the incremental visualization of success. The division of content into chunks, and the recording of progress based on these chunks, allows the learner to maintain an awareness of their progress. ECE embraces studies or projects on a topic – these studies encourage children to explore an area of interest in a prolonged manner, building both skills and knowledge through a range of interactions and experiences. Therefore, the organisation of material in ECE provides opportunities for delivering some or all elements of such studies using gaming elements.

ECE philosophies require that learners receive relevant, appropriate, timely, non-threatening feedback; this aligns closely with the feedback systems embedded in traditional gaming.

When designing game-based learning objects, it is important to develop systems that assess children's learning as they engage with the technology, to ensure they are meeting appropriate and expected progress [40]. Learners' progress, and hence the evaluation of their learning, can be represented through levels, points, or even visual reward.

Reward structures depict the ramp up and are linked to unlocking content. As children demonstrate their increased knowledge and/or skills (through completing activities and acquiring points), they are rewarded by being promoted to higher levels. This increases the child's status within the game and is an indication of progression through content [33]. By gradually increasing the difficulty of the learning

experience by delivering more detailed content or requiring the application of more highly developed skills, children's learning is scaffolded. This contributes to the development of competency within the child, as described in the Reggio Emilia philosophy [41].

Learners are rewarded with points when they complete an activity or assessment. Learners can also be rewarded with points (or other items linked to a learner's status – for example, a badge) for positive non-academic contributions such as providing support to another learner or making a valuable contribution [33]. Points are usually visible to other learners. These points and badges serve as a continual motivator and status indicator of both academic achievement and behavioural contributions within a game. Collaboration provides the opportunity for the child to share knowledge, thereby increasing their awareness of relationships and social structures.

Investment is achieved through a learner's feelings of pride in his/her work and the game. A personal profile (game terminology: avatar) gives each learner a unique online presence. The creation and customization of this profile (for example, by assigning it a picture, name and preferences) gives the learner an online presence that he/she can 'own'. This avatar concept is an essential element of gamification.

A learner's pride in their work is one of the main features of the 'individual assets' component of the PTD framework [42].

Achievements: earn public recognition for completing work. Activities attempted and completed by a learner are recorded on the avatar profile using points. Points information is typically public within the game, published on a leaderboard or through a list of top scores (game terminology: leaderboard, top scores). This encourages a focus on positive [33]. Implementation of such features in ECE must be thoughtfully considered, given the importance of constructive feedback as opposed to rewards.

Publishing of points information also increases social interaction around the game because it encourages learners to discuss their progress with others [33], and may also motivate learners through peer comparison. Again, this information must be communicated in a developmentally appropriate way.

Given the importance of communication between educators, children and their carers, achievements recorded through gamified interactions could be used to share progress updates between members of each child's learning community.

Actions and Events are used to encourage learners to check in to receive new challenges. Intentional and regular interaction with technology is now a key component of early childhood curriculums, and one aspect of designing developmentally appropriate classrooms [43]. The use of deadlines or scheduled appointments, as is common in gaming, can be applied in educational contexts to encourage users to regularly engage with the game [33]. Learners may be required to complete a specified level or activity, or gain a specified number of points, within a set timeframe or by a set date. They may also be rewarded with bonuses based on their points at a specified time. This tool acts as a motivator for continual learning. Push notifications are used by some games to contact learners directly. These notifications act as reminders to engage with the game, increasing initiation of game engagement that is independent of the instructor. Such activities would require modification to be useful to ECE, however they may be useful in high-tech environments where children log in to technology systems regularly (for example, signing in upon arrival at the educational institution in the morning).

Engagement is reflected by working with others to accomplish goals. A learner's avatar can belong to a group and have access to closed group information [33] (for example, notifications, news and updates about other group members or shared interest information). Bers' [42] PTD framework refers to the importance of children's ability to use technology to accomplish a goal ('competence'), to assist others with their use of technology ('caring') and to use technology for form and maintain positive relationships ('connection'). It also highlights the role technologies can play in learners "interchanging thoughts, opinions, or information" [42] ('communication'). There must be a balance between child-initiated technology experiences and other interpersonal experiences involving both small and large groups and offline collaborations [40], with the development of social skills essential for children.

Abstractions of concepts and reality are offered in some learning environments; learners have the ability to convert their points or badges (game terminology: badge) into 'virtual goods' or be transferred into various types of financial compensation [33]. When these rewards appeal to the learners, they will act as high level motivators and enhance learner engagement. In traditional gaming, epic meaning almost always equates to a personal gain. This focus on praise or personal gain does not align well with ECE, where educators are concerned with providing constructive feedback [40].

Gaming elements can be used to teach children that small actions can have a significant impact in real world environments. This understanding aligns with the concepts underlying the increasingly popular

cooperative games for social change. The PTD framework also highlights the importance of children understanding that technology can contribute to solving larger problems that benefit society ('contribution') [42]. For example, using technology to collaboratively role play possible responses to international conflict, or simply using it to build online connections that translate to supportive (often offline) communities.

Investment is achieved by incentivizing learners to involve others. The publication of a learner's scores (game terminology: leaderboard, top scores) encourages learners to discuss their progress with others [33] and this information may be shared as a status symbol. Effective bonuses can incentivize participation. From a social perspective, [42] identifies the ability of technologies to enhance collaboration and caring, and to engage in community building ('collaboration' and 'community building').

In the ECE context, children must develop a range of basic skills before being offered opportunities to engage in information exchange and communication using technology. When ready, these exchanges could include interactions between the software, the child, classmates, the teacher and other members of the school community [43]. Such exchanges at an early childhood level are likely to be concerned more with social interactions than issues of status.

Curve of interest is built by unlocking information continuously. Activities, topics and courses can be divided into the smallest chunks of coherent content, based on cascading information theory [33]. Learners can absorb this content at a high level, or have the ability to navigate more deeply to discover more. The achievement of learning outcomes embedded in each chunk of content is demonstrated by a learner being awarded points (game terminology: points) for the learning tasks in that chunk of content. This design approach fits closely with the use of studies or projects, allowing educators to deliver small components of information that fit with the comprehension and attention span of children. The delivery of information in small chunks with increasing levels of challenge can be used to guide children through their personalized learning experience [43].

Game state refers to the need to tackle challenges within a limited amount of time. Cambourne's [44] Conditions of Learning specify that all learners need time and opportunity to use and practice new learning in realistic ways. This view is widely supported in educational literature, including for ECE. Imposing time limitations on learning experiences is one element of gaming that should not be applied to ECE. Child-directed play should be relatively free of externally imposed rules; it should be active and exploratory [21]. Time limitations are incompatible with this approach.

Storytelling involves navigating through your learning environment and uncovering pockets of knowledge. This suggests that learning journeys are limited to pre-defined content which can be uncovered by learners. This description contradicts the usual view of a 'game' where users can explore freely and find content in an unstructured manner. While Knewton's description does not match this usual understanding of storytelling in gaming, the idea of discovery is highly relevant to ECE. Children are encouraged to explore areas of personal interest and engage with new material as it is revealed to them. In ECE, it is important that discovery makes use of various devices, software, and apps that encourage creative thinking and offer multiple divergent learning paths [43]. This use of technology to build creative, open-ended experiences is one area lacking development to date.

Replay, do-over or infinite play allows you to learn continuously until you become an expert. The completion of learning activities allows the learner to build skills and/or knowledge. The completion of evaluation activities allows the learner to demonstrate their acquired skills and/or knowledge. Both learning activities and assessment activities can be used to assign the learner rewards [33] (game terminology: points). While perseverance of learners is linked to confidence in the PTD framework [42], technology-based gaming needs to be moderated in ECE. The Early Childhood Environment Rating Scale – Revised [45] recommends that no more than 20 minutes per day should be spent sitting at a device to play educational games. On the other hand NAEYC [6] do not prescribe a specific time limit of use, instead relying on the teacher to use their professional judgment to monitor engagement with the technology. This is supported by [43] who advocate the development of classroom-based systems to monitor children's use of technology, and hence ensure that they are spending appropriate amounts of time engaging in a range of choices.

Investment/Fulfilment are achieved by working on challenges that require multiple skills to solve. The PTD framework's technology-mediated behaviors component [42] lists a range of technology-facilitated activities that children can undertake to build desired behaviors. Many of these activities (for example, 'content creation', 'creativity' and 'communication') can be combined to build

challenges that require multiple skills to solve. When children complete independent technology-based activities in small groups (i.e. without adult facilitation), educators can use this as stimulus for child-based reflection about what they learnt or experienced [43], thereby developing a range of communication skills.

6. Future Directions

The research presented in this paper is part of a larger ongoing project. The authors are engaged in two funded projects that are creating smartboard resources for preschool children. Underlying the delivery of these resources are the following areas of inquiry:

- Establishing understanding of technology-driven learning experiences for ECE educators,
- Aligning child-driven learning encounters to gamified experiences, and
- Testing the suitability of gamification in ECE through empirical data analysis.

7. Conclusion

This paper has presented a comprehensive list of gaming concepts and considers the appropriateness of these to the early childhood education environment. The analysis of these motivational factors is in response to the growing focus of technology access by the children of Generation Alpha. There are many impacts of this increase of technology adoption at such a young age of exposure. The intrinsic connection between play and technology has been enhanced through the adoption of touch-screen technologies and natural interface devices. By creating an awareness of this early adoption of technology and the potential impact of gamification elements it is essential that early childhood educators are prepared to engage. Gamification, or intrinsic motivation, is most definitely an influence in the realm of technology-based play for this generation of children.

6. References

[1] Marlow Riedling, A., An Educator's Guide to Information Literacy; What Every High School Senior Needs to Know, Book News, Inc., Portland, United States, Portland, 2007.

[2] Bennett, S., Maton, K., and Kervin, L., "The 'Digital Natives' Debate: A Critical Review of the Evidence", British Journal of Education Technology, 39(5), 2008, pp. 775-786.

[3] Prensky, M., "Digital Natives, Digital Immigrants", On the Horizon, 9(5), 2001, pp. 1-6.

[4] Unesco. *Ict in Education*. 2011 [cited 2012 23 April]; Available from: http://www.unesco.org/new/en/unesco/themes/icts/.

[5] Acara. *The Australian Curriculum*. 2012 03 September 2012 [cited 2013 20 February]; Available from: www.australiancurriculum.edu.au.

[6] Naeyc. *Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8*. 2012 23 April 2012 [cited 2013 2 March]; Available from: http://www.naeyc.org/files/naeyc/file/positions/PS_technology_WEB2.pdf.

[7] U.K. Department for Education. *Ict Curriculum*. 2012 [cited 2012 23 April]; Available from: http://www.education.gov.uk/schools/teachingandlearning/curriculum/a00199693/use-of-ict.

[8] Turja, L., Endepohls-Ulpe, M., and Chatoney, M., "A Conceptual Framework for Developing the Curriculum and Delivery of Technology Education in Early Childhood", International Journal of Technology and Design Education, 19(4), 2009, pp. 353-365.

[9] Deewr. *Belonging, Being & Becoming: The Early Years Learning Framework for Australia*. 2009 [cited 2013 10 February]; Available from: http://deewr.gov.au/early-years-learning-framework.

[10] Blaiklock, K., "Curriculum Guidelines for Early Literacy: A Comparison of New Zealand and England", Australasian Journal of Early Childhood, 36(1), 2011, pp. 62-68.

[11] Nz Ministry of Education. *Te Whāriki: He Whāriki Mātauranga Mō Ngā Mokopuna O Aotearoa Early Childhood Curriculum*. 1996 [cited 2013 10 February]; Available from: http://www.educate.ece.govt.nz/~/media/Educate/Files/Reference%20Downloads/whariki.pdf.

[12] Uk Department for Education. *Statutory Framework for the Early Years Foundation Stage*. 2012 [cited 2013 10 February]; Available from: https://www.education.gov.uk/publications/eOrderingDownload/00267-2008BKT-EN.pdf.

[13] Naeyc. *Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8. Position Statement. , Dc:* . 2009 [cited

2013 14 March]; Available from: www.naeyc.org/files/naeyc/file/positions/position%20statement%20Web.pdf.

[14] Synodi, E., "Play in the Kindergarten: The Case of Norway, Sweden, New Zealand and Japan", International Journal of Early Years Education, 18(3), 2010, pp. 185-200.

[15] Farné, R., "Pedagogy of Play", Topoi, 24(2), 2005, pp. 169-181.

[16] Edwards, S., and Cutter-Mackenzie, A., "Environmentalising Early Childhood Education Curriculum through Pedagogies of Play ", Australasian Journal of Early Childhood, 36(1), 2011, pp. 51-59.

[17] Ball, D., and Forzani, F., "What Makes Education Research 'Educational'?", Educational Researcher, 36(9), 2007, pp. 529-540.

[18] Grieshaber, S., "Interrupting Stereotypes: Teaching and the Education of Young Children", Early Childhood Education and Development, 19(3), 2008, pp. 505-518.

[19] Fleer, M., *A Cultural-Historical Perspective on Play: Play as a Leading Activity across Cultural Communities*, in *Play and Learning in Early Childhood Settings*, Pramling-Samuelsson, I., Editor. 2008, Springer: Dordrecht.

[20] Johnson, J., Christie, H., and Wardle, F., Play, Development, and Early Education, Pearson Education, Inc., Boston, 2005.

[21] Stovers, S., Play's Progress? Location Play in the Educationalisation of Early Childhood in Aotearoa New Zealand, Auckland University of Techology, 2011.

[22] Oecd. *Executive Summary: Starting Strong Ii: Early Childhood Education and Care*. 2006 [cited 2013 27 Febrary]; Available from: http://www.oecd.org/edu/school/startingstrongiiearlychildhoodeducationandcare.htm.

[23] Bodrova, E., and Leong, D., *Play: A Vygotskian Approach*, in *Early Childhood Series*. 1996, Davidson Films.

[24] Tootell, H., Plumb, M., Hadfield, C., and Dawson, L., "Gestural Interface Technology in Early Childhood Education: A Framework for Fully-Engaged Communication", Hawaii International Conference on System Sciences (HICSS), 2013

[25] Beeland, W., "Student Engagement, Visual Learning and Technology: Can Interactive Whiteboards Help?", Action Research Exchange, 1(2002,

[26] Glover, D., and Miller, D., "Running with Technology: The Pedagogic Impact of the Large-Scale Introduction of Interactive Whiteboards in One Secondary School", Journal of Information Technology for Teacher Education, 10(3), 2001, pp. 257-278.

[27] Kaufman, D., "How Does the Use of Interactive Electronic Whiteboards Affect Teaching and Learning?", Distance Learning, 6(2), 2009, pp. 23-33.

[28] Smith, H., Higgins, S., Wall, K., and Miller, J., "Interactive Whiteboards: Boon or Bandwagon? A Critical Review of the Literature", Journal of Computer Assisted Learning, 21(2), 2005, pp. 91-101.

[29] Serious Games Initiative. *The Serious Games Initiative*. 2002 [cited 2013 3 August 2013]; Available from: http://www.seriousgames.org.

[30] Miller, A. *Gamification Vs. Game Based Learning in Education*. 2013 [cited 2013 3 August 2013]; Available from: http://www.gamification.co/2012/01/13/gamification-vs-game-based-learning-in-education/.

[31] Erenli, K., "The Impact of Gamification: A Recommendation of Scenarios for Education", 15th International Conference on Interactive Collaborative Learning, , 2012, pp. 1-8.

[32] Kapp, K., The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education, John Wiley & Sons, San Francisco, CA, 2012.

[33] Muntean, C., "Raising Engagement in E-Learning through Gamification", The 6th International Conference on Virtual Learning ICVL 2011, 2011, pp. 323-329.

[34] Malone, T., and Lepper, M., "Making Learning Fun: A Taxonomy of Intrinsic Motivation for Learning", in (Snow, R., and Farr, M., 'eds.'): Aptitude Learning, and Instruction Lawrence Erlbaum Associates, London, 1987

[35] Deterding, S., Dixon, D., Khaled, R., and Nacke, L., "From Game Design Elements to Gamefulness: Defining "Gamification"", MindTrek'11, 2011, pp. 9-15.

[36] Salen, K., and Zimmerman, E., Rules of Play - Game Design Fundamentals, The MIT Press, Cambridge, 2004.

[37] Kapp, K., "Games, Gamification, and the Quest for Learner Engagement", T + D, 66(8), 2012, pp. 64-68.

[38] Bjork, S., and Holopainen, J., Patterns in Game Design, Charles River Media/Cengage Learning, Hingham, 2004.

[39] Knewton. *The Gamification of Education Infographic*. 2012 [cited 2012 12 February]; Available from: http://www.knewton.com/gamification-education/.

[40] Nemeth, K., and Simon, F., "Preschool Curriculum and Technology Crosswalk", EETC Early Education and Technology for Children, 2012

[41] Bredekamp, S., "Reflections on Reggio Emilia", Young Children, 49(1), 1993, pp. 13-17.

[42] Bers, M., Designing Digital Experiences for Positive Youth Development: From Playpen to Playground, Oxford University Press, New York, 2012.

[43] Simon, F., and Nemeth, K., Digital Decisions: Choosing the Right Technology Tools for Early Childhood, Gryphon House, Lewisville, NC, 2012.

[44] Cambourne, B., The Whole Story Natural Learning and the Acquisition of Literacy in the Classroom, Ashton Scholastic, London, 1988.

[45] A+ Education Ltd. *The Early Childhood Environment Rating Scale – Revised (Ecers-R)*. 2012 [cited 2013 14 March]; Available from: http://www.ecersuk.org/4.html.