The Use of Mobile Videogames in Education: The Case of The Elm City Stories

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Abstract

The purpose of this study is to examine the ways in which mobile videogames can be used in non-formal educational environments, to support students to develop decision-making skills through negotiated play. In the context of this qualitative case study, the health literacy mobile videogame, *PlayForward: Elm City Stories* developed at Yale University was implemented in an afterschool setting in Cyprus.

The game was implemented through a collaborative pedagogical framework, based on the primary theoretical premises of social constructivism, where students had the opportunity to play the game in groups, and negotiate the meaning-making and learning process. In this format, social trajectories were developed among students, attracting students to the game play and assisting the development of their social skills. The case study addresses the fragmentation of young students from core health literacy skills development, the decontextualisation of health literacy initiatives, the absence of an instructional framework for the use of mobile videogames in non-formal education, and the dichotomy between formal and non-formal education.

This research explores how students negotiate meaning, make decisions, and interpret the consequences in a non-formal education context, through an ethnographic, interpretive, and symbolic interactive framework. This investigation was based on a qualitative case study research methodology, and data were analyzed using open coding strategies to look for patterns in students' discourse, and their interactions, as they played the game.

Keywords: mobile videogames, health literacy, negotiated play, social constructivism, decision-making, non-formal learning

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Declaration

The current doctoral dissertation was carried out by Sotiris Themistokleous. All parts of this dissertation are authentic work of the undersigned, and no section of it has been used for any other purpose, at any University, beyond the current qualification.

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1. Introduction

1.1. Research Overview

Research in the field of young students participation in mobile learning is a relatively new research area with most aspects of the research lacking the provision of an instructional and theoretical framework of mobile learning or focusing on the behaviorist approach (Murray & Olcese, 2011; Park, 2011). Moreover, there is an agreement in the literature (Arnab, Brown, Clarke, Dunwell, Lim, Suttie, Louchart, Hendrix, & De Freitas, 2013) that youth remains detached from core social and health literacy skills associated with their low capacity to take informed decisions, which leads to increased exposure to addictions and health risks (Hieftje, Duncan, & Fiellin, 2014; Lesta, Lazarus, & Essén, 2008; Mogford, Gould, & Devoght, 2010). International literature also provides evidence that policy makers, school leaders and teachers either neglect the multidimensional social aspects of health literacy, or place the emphasis on incorporating health literacy in formal contexts, which keeps it fragmented from the wider civic ecosystem. An approach to this challenge, as the argument put forward in this research suggests, lays within the use of mobile videogames in non-formal education settings, to advance students' health literacy and associated skills (critical thinking, collaboration, decision-making), in contextualized environments.

According to the World Health Organization, health literacy is the nexus of "social and cognitive skills" which define the capacity of persons to access and manage health related information through active interaction, participation and critical analysis (World Health Organization, 2013). Health literacy moves beyond information provision and knowledge development and into skills development, social interaction, and critical understanding, through active participation in the wider socioeconomic context. Therefore, health literacy is the capacity of a person as a citizen to be engaged

in informed collaboration, communication and collective decision-making (Ioannou, Kouta, Constantinidou, & Ellina, 2014; Hernandez, 2013).

The current research addresses health literacy in the wider context of skills development. Such skills and characteristics, which are vital for health literacy, include critical thinking, that is, the ability to assess, analyze and reflect on information and practices, acquiring organizational skills to develop networks and collaborations, communication and negotiation skills to make decisions and solve problems, (Erentait et al., 2012; McLeod, 2000; Montgomery et al., 2004). Moreover, health literacy translates to "the opportunity to be part of a decision-making process for creating a supportive environment for desirable health behavior" (Ioannou et al., 2014). However, there are limited initiatives that support students' collaboration and interaction, contextual learning and critical thinking (Arnab et al., 2013; WHO, 2010).

As policy documents and research evidence show (DeSmet, Van Ryckeghem, Compernolle, Baranowski, Thompson, Crombez, Poels, Van Lippevelde, Bastiaensens, Van Cleemput, & Vandebosch, 2014) ; Bennett, Wells & Rank, 2009; Wells & Freelon, 2009; Bennett, 2008; Bennett, Jenkins, Clinton, Purushotma, Robinson, & Weigel, 2007), the existing models of education have not taken advantage of the merits and possibilities of Information and Communication Technologies (ICT). This is mainly due to the fact that new educational tools do not come to challenge the existing models of education, but to complement them (Amiel & Reeves, 2008). Following this line, instructional designers, educators and educational policymakers preserve the top-down approach of education, fragmented in the rigid formal curriculum (Ioannou, et al. 2014; Lesta, et al, 2008).–In addition to these limitations, there is, among education stakeholders, a perception of a deep dichotomy between formal and non-formal education, which restricts the provision of a contextualized, needs -

oriented and skills-oriented mode of learning (Ito, Baumer, Bittanti, Boyd, Cody, Herr-Stephenson, 2009; Looi, Seow, Zhang, So, Chen & Wong, 2010). In spite of a gradual interest by many researchers who defend the importance of mobile videogames in contemporary pedagogical approaches, there is an absence of an instructional framework for practical implementation in formal and non-formal settings (Koutromanos & Avraamidou, 2014). Furthermore, what is available in pedagogical models, based on the use of games, focuses on students of upper classes and mainstream courses, such as math, science and history (Murray & Olcese, 2011; Park, 2011).

Therefore, the overall purpose of the present research is to examine opportunities and challenges of the use of mobile videogames, particularly, the *PlayForward: Elm City Stories* in non-formal educational environments to support students develop decision-making skills through collaborative play, associated with health literacy. The subject of investigation was the 5 groups of students and how they interacted with the game, and the interactions of the members among them.

Specifically, in this study I examine the use of the game on i-Pads in an after-school setting, in supporting young students to build their health literacy skills, explore their collaborative decision-making process, and investigate, from an ethnographic, interpretive, and symbolically interactive framework the social processes that take place during their play.

It is in relation to the abovementioned gaps, challenges and purposes that the idea put forward in this research is based, thus the following research questions were conceptualized to guide the research.

1. What are the potentials and challenges of using the *PlayForward: Elm City Stories* mobile videogame for promoting health literacy in a non-formal educational context?

2. According to students' perceptions, what are the affordances of the *PlayForward: Elm City Stories* mobile videogame, which can facilitate or hinder collaborative decision-making skills development?
3. How are social gaming trajectories shaped during negotiated play in a social constructivist context, with the use of the *PlayForward: Elm City Stories* mobile videogame in a non-formal educational setting?

A review of related literature indicates that mobile videogames are engaging for the youth, offering them greater levels of collaboration, discourse and creativity, which they would not experience within traditional learning environments, or even through static computers (Hense & Mandl, 2014; Su and Cheng, 2013; Kiger, Herro, Prunty,2012; Raphael, Bachen, Lynn, Baldwin-Philippi & McKee, 2010).

Mobile videogames are attached to the contemporary flexibility of access, interaction, acquisition and meaning-making of information and knowledge, through gamified environments, with the use of smart-devices also associated with current youth culture (Koutromanos & Avraamidou, 2014; Park, 2011). The term "mobile videogames" was selected over other terms, such as serious games, as it is the term mainly used by the design and development team of the *PlayForward: Elm City Stories* mobile videogame (Fiellin, Kyriakides, Hieftje, Pendergrass, Duncan, Dziura, & Fiellin, 2016; Montanaro, Fiellin, Fakhouri, Kyriakides, & Duncan, 2015). Moreover, "serious games" as a term is attached to formal educational contexts (DeSmet, Van Ryckeghem, Compernolle, Baranowski, Thompson, Crombez, Poels, Van Lippevelde, Bastiaensens, Van Cleemput, & Vandebosch, 2014; Gibson, 2012).

Researchers argue that mobile gaming bridges the gap between formal and non-formal education, and connects the latter to personal experiences, while developing interpersonal skills by

discussing their findings with co-gamers (Looi, Seow, Zhang, So, Chen & Wong, 2010; Ito, Baumer, Bittanti, Boyd, Cody, Herr-Stephenson, 2009).

Non-formal education refers mainly to a learning process that occurs outside the formal curriculum, which, nevertheless has pre-defined learning objectives (a distinction from informal learning). It is highly associated with contextualized learning, directly linked with skills development in fields such as health literacy, and it has a flexible, inclusive and needs-oriented approach. It is provided in the context of thematic clubs by non-governmental organizations, or after-school programs, and is directly connected with wider communities. Its format can take many shapes, as it is mostly project-based, enriched with collaborative problem solving activities, and connected with the participants' real-life environments (Kedrayate, 2012; Latchem, 2014; Xhafa, Fernandez, Daradoumis, Barolli, & Caballé, 2007).

Game experiences can mirror daily routine scenarios, allow the provision of instant feedback, and be flexible in their flow. Games need to have real-life representations, and also an emphasis on consequences following actions, where young gamers need to reflect upon the outcomes of their decisions (Blumberg, Almonte, Anthony & Hashimoto, 2012; Raphael et al., 2010; Ryan, Rigby & Przybylski , 2006).

Gaming is based on interaction, collaboration, active and dynamic learning, and a non-formal educational process that is invaluable. Such activities can help users to dynamically engage in health literacy and skills development (Fuchslocher, Niesenhaus, & Krämer, 2011). Nevertheless, the majority of literature on the field reports that gender and racial stereotyping dominates the field of gaming, and researchers seek, therefore, alternatives ways to raise awareness on the matter (Miller, Pater, & Mynatt, 2013). Games which are linked with health literacy and social contexts allow users

to explore hitherto unattainable situations and learn from simulated experience, enhancing critical reflection on health risk circumstances and building skills for collective decision-making and critical thinking (Blumberg et al., 2013; Kahne, Lee & Feezell, 2013; Bers, 2008; Lawy & Biesta, 2006; Paechter, 2000).

Mobile videogames, as will be discussed in a later sub-section, are directly linked with a social constructivist framework. In such a pedagogical ecosystem, students are involved in a collaborative learning process through negotiated play, generating social trajectories with the overall environment, their groups' members, their social skills development and the game's learning objects (Hense & Mandl, 2014; Powell & Kalina, 2009).

The use of mobile videogames in education has been linked with social constructivism, as students' learning experiences escalate in a progressive manner (scaffolding), where they deploy old and construct new knowledge (Bers, 2008; Hernandez, 2013). Games provide the opportunity to students to engage in simulations of real environments, interact directly with all elements and tools available, and reflect on their actions in the game, in relation to real-life experiences, in a metacognition process (Mishra, 2014; Naismith, Sharples, Vavoula, & Lonsdale, 2004). Moreover, social constructivism is characterized by the development of multiple understandings, ideas and skills in authentic environments, rather than the acquisition of information for data and terminologies. Such a pedagogical approach is also linked with the learning formats games can offer (Windschitl, & Sahl, 2002).

As a pedagogical approach, social constructivism encompasses collaborative learning, a "social process" where participants also deploy old knowledge and develop new understanding through negotiations and discussions with peers (Antle, Bevans, Tanenbaum, Seaborn, & Wang,

2011; Schuck, Aubusson, Kearney, & Burden, 2013). Collaboration has strong elements of negotiations and meaning-sharing, which requires a set of skills to be beneficial as a learning process (Mishra, 2014). Therefore, in the context of implementing a game case study, I was interested in investigating the impact of the groups' negotiated play and, eventually, decision-making process, on students' skills development. (Olson, 2010). Decision-making requires, beyond a basic comprehension of technical and informational knowledge, skills to contextualize the knowledge. Students need to take the right path of choices and decisions, through information and opinion assessment and constant negotiation (Galotti, 2002; Nicolaou, Korfiatis, Evagorou, & Constantinou, 2009). Therefore, in the current research, we use the term negotiated play as an extension of collaborative learning, which better describes the play process of a group (Naismith et al., 2004). In doing so, we pay attention to the ways in which students, through a dialogical process, negotiate their views and understandings with others to come to an agreement.

Part of this extended framework of social constructivism and negotiated play is the buildup of social trajectories among the students. Such trajectories are the interpersonal relations created between students, and the connection of their play experience with their extended social environment, generating new knowledge, not necessarily connected with the learning objectives of the game (Clements, & Sarama, 2014). Therefore, social trajectories are another important side-effect of negotiated game play in a social constructivist format, which encompass a learning process connected to meanings and skills development (Dabbagh, & Kitsantas, 2012).

In analyzing the data, we looked for evidence of such social trajectories among the students as evident in their discourse, especially in the context of their everyday lives. In other words, we

looked for instances where the game provided opportunities to students to share ideas and personal experiences beyond the content of the game.

As illustrated above, it is argued that games have the potential to support teaching and learning in various ways. These are summarized into the following:

1. Visualization and Contextualization of real life learning conditions through the game play environment (Lankshear & Knobel, 2011; Grummell, 2010; Schugurensky & Myers, 2008;)
2. Learning by doing, Experimentation and Creativity through the story-line and game challenges (Hamari, Koivisto & Sarsa, 2014; Deterding, Dixon, Khaled & Nacke, 2011; Moreno-Ger, Burgos, Martínez-Ortiz, Sierra & Fernández-Manjón, 2008; Muntean, 2011)
3. Autonomous interaction in terms of time and space due to its mobile availability (Caroline Faure, & Kelle, 2013; ; Ray, Faure, & Kelle, 2013; Joosten, 2010)
4. Social skills development, such as decision-making, networking and leadership through simulations and role-playing (Arnab et al., 2013; Raphael, Bachen, Lynn, Baldwin-Philippi & McKee, 2010; Kahne, 2008)

In the abovementioned context, some novelties of this research are found in the following aspects of the case study:

1. One of the first implementations and investigations of a mobile videogame in a Cyprus non-formal education environment
2. Health literacy learning objectives and opportunities were introduced to Cypriot students
3. The particular game was only tested with a single player mode
4. All previous research on the specific game use quantitative research methods

Tested in the current case study implementation was the *Elms City Stories*, developed by the play2PREVENT Lab (http://www.play2prevent.org/) of the School of Public Health of YALE University. The *Elms City Stories* resembles the life of a student, of which its character was built by the gamer. The student faces real-life challenges associated with social, health and wellbeing issues (skipping classes, taking drugs, unprotected sex, hanging out with strangers), which need to enter a decision-making process. The game character's decisions are reflected in the course of the game, helping the gamers to visualize how different choices bring different, positive, or negative results to their lives. Decision-making, critical thinking, trial and error, visualization and collaboration, are all skills which can be developed through this mobile videogame, and are essential for the young students real-life challenges (Fiellin, Hieftje & Edelman, 2013). Although the game was developed for a US context, for single play, and was only tested based on quantitative data collected from the game mechanics, in the current study, we tested it among groups of students of a school in Cyprus through a qualitative single case study approach.

"The essence of a case study is that it tries to illuminate a set of decisions, why they were taken, how they were implemented, and with what result." (Schramm, 1971, p. 6). A single case study is flexible in carrying out a detailed investigation of the real-life complex processes, empirical interactions, and discourses that students engage with as they play mobile videogames (Merriam, 2009; Gummesson, 2005; Schell, 1992). "A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations). The boundaries of the phenomena are not clearly evident at the outset of the research and no experimental control or manipulation is used." (Benbasat, Goldstein, & Mead, 1987, p. 370).

The data analysis was based on the inductive and deductive stages (Stake, 2011; Patton, 2002). At the inductive stage, the data collected were classified in coded categories (i.e., game content, design, usability, interactivity, decision-making), (Glaser, 1978). As part of the process above, I developed assertions, which are statements that give a sense of generalization through data cross-analysis. At the deductive stage, there was a process of validating or rejecting the assertions. This process required a cross-checking between different categories, to identify overlaps or intersections. Assertions were only valued through a satisfactory number of data (Vrasidas, 2014). The overall approach is associated with the discourse analysis methodology, where the examination of context and interaction shapes events, perceptions and characteristics involved in the wider environment under investigation (Gee 2003; Gumperz 1982).

1.2. Significance

A number of research studies carried out with students have shown that online forms of health literacy building and skills development may reduce their exposure to health risks especially when combined with their offline activity (Arnab et al., 2013; Miller et al., 2013; Olson, 2010). The areas of health literacy, collaboration, decision-making and critical thinking correlate significantly with each other as reported in related literature (Hernandez, 2013; Xie, 2011). Online activities are often quite accessible and require less “resources”. In light of these, the mobile videogame tested in this study can be considered a valuable learning tool, a modern and alternative way of non-formal learning, especially for the younger generations who are, after all, the most avid users of such games. Certain “normalisation” studies have shown that online learning engagement causes an increase in offline informed decisions and actions.

The *Elm City Stories* game implemented in this study, the direct outcomes of a user's actions in a web-based game, are in a viewable online format not only for the actual gamer but also for others. The structures that appear to be codified in the digital world will be instantly translated in real life social actions that can further entail patterned social categories. In this way, cognition, information and consciousness shall emerge from and generate localized and universal cultural forms. This study aims to document and critically examine a group of students' interactions in the context of a health literacy mobile videogame, and to provide valuable resources and guidelines for teachers, instructional designers, educational game developers and education stakeholders, for the purpose of advancing the learning potentials in non-formal mobile educational environments.

More specifically, the significance of the present research study is in the following:

- It has the potential to contribute to the field of mobile technologies and education, and to the scarce literature on the use of games embedded in mobile technologies.
- It addresses a gap in the literature of the use of games by younger students (13-15 years old) in an after-school setting in the context of health-education, which is largely unexamined.
- It illustrates the meaning-making processes and sheds light on the interactions and kinds of discourses that students engage with as they interact with the game and each other in order to make decisions.

1.3. Research Report Synopsis

The research report consists of 6 chapters: introduction, literature review, research methods, findings, discussion, and, summary and recommendations. A brief overview of each of the chapter's content follows.

Chapter 1: The introduction sets the ground for the study by offering a justification for the need as well as the value of using mobile videogames in education. As well-argued in the introduction, games have a set of advantages that have the potential to support teaching and learning in various ways.

Chapter 2: The aim of this chapter is to review existing literature on mobile videogames, and specifically, on their design and their affordances in alignment with the basic features of health literacy. The chapter includes 4 subsections: health literacy definition and progresses, gamification of learning, decision-making and mobile videogames, and educational game design and development. These 4 sub-sections serve to outline and propose the basic game design principles that are compatible with the learning objectives of the proposed health literacy framework, and specifically, the attraction of students to engage in a collaborative game play to improve their decision-making related skills in the context of health literacy. The *PlayForward: Elm City Stories games*, which was used in the case study implementation, encompasses these characteristics, as described later on. Players have the ability to see how their choices affect their lives and subsequently are able to move back in time to see how different actions might have led to different outcomes. By negotiating challenges in a highly repetitive and meaningful way, players learn skills that translate to real-life, equipping them to avoid situations that increase the risk of smoking and alcohol use, and other possibly negative outcomes of health.

Chapter 3: This chapter describes the theoretical framework in which the design of the study was framed and offers thick descriptions of the context as well as the procedures of data collection. The research explored how students negotiate meaning, make decisions, and interpret the consequences in a non-formal education context, through an ethnographic, interpretive, and symbolic interactionist/interactive? framework. A "single Case Study Research Methodology" was used as a

methodological approach to address the goal of the study (Dul, & Hak, 2007; Meyer, 2001; Miles, 2015; Zainal, 2007). A single case study approach allows for deep exploration of the students' engagement with the game, along with the collection of data from various sources of information, such as, video-based observations, interviews, as well as an analysis of the game-output (Merriam, 2009). The central pillar of this research is the examination of the decision-making processes through negotiated play. A particular focus is placed on the limitations and challenges of taking a decision, and the nature of blurry boundaries that influence it (Miles, 2015). Case design, implementation and analysis is fully appropriate for such a challenge (Baxter & Rideout, 2006), where a non-formal educational environment in a private school provides the opportunity for a decision-making game play. The case study implementation took place in a private school in the suburbs of Nicosia, Cyprus, with the voluntary participation of 15 students of lower secondary education. The implementation was conducted during after school hours for 5 weeks (8th of February 2016 – 9th of March 2016), at 2 hours per week. The students were grouped in teams of 3 and played the game, collaboratively. The data from the case study implementation collected were as follows:

- Video-taped interactions of each groups of students (5 meetings x 1.5 hours)
- Game-logs for each group of students
- Field research notes
- Researcher's diary (6 diaries, 2 A4 long each)
- Post-implementation semi–structured interviews with each of the students (40 minutes long)

The data analysis included two stages, the inductive and the deductive (Stake, 2011; Patton, 2002). At the inductive stage, the data collected were coded and classified in categories, using open code

techniques (Glaser, 1978). These categories were reviewed resulting in higher-order categories, by merging or rejecting previous subcategories or labels. Based on the higher-order categories and coded data, five assertions were developed, which are statements that give a sense of generalization through a data cross-analysis. At the deductive stage, there was a process of validating or rejecting the assertions. This process required a cross-checking between different categories to identify overlaps or intersections of supportive or contradictive data, eventually validating, rejecting or merging the assertions.

Chapters 4 & 5: These chapters present the main findings of the study through 5 main assertions that are offered alongside evidence from the data in the form of direct quotes from the interviews held with the students and/or the groups' discourse during play. The five main assertions are offered in chapter 4 and are discussed alongside existing literature in chapter 5. These are as follows:

1. The affordances of the game, such as the variety of play modes, the technical aspects of the game (sound, usability, rating system, and visuals), the support for collaborative play, the game narrative connections to real-life contexts, and the potential for skills development, guided the learning game-play experience of the students.

2. Students believed that their participation in the *PlayForward: Elm City Stories* mobile videogame implementation case study, facilitated their engagement in decision-making, and developed their communication and critical thinking skills in a conscious and comprehensive manner; however, in reality their participation in decision-making didn't illustrate negotiations of ideas.

3. Negotiated and collaborative play in teams shaped social gaming trajectories, such as students' inter-personal relations, self-reflection on students' own life experiences, and discussions beyond the game themes.

4. Integration of the game for health literacy education generated a series of opportunities and challenges, such as the attractiveness of collaborative play and learning, the promotion of a customized needs-oriented learning, the bridging of formal and non-formal education modes, and the appearance of a learning curve, which students need to go through to become familiar with the game.

5. Students developed positive perceptions about the use of games in education, as they thought that the collaborative game play supported the development of a variety of skills, empowered them to learn the content, and offered alternative educational modes of interaction and learning.

The assertions above are directly linked with the research questions as demonstrated in the table below.

Chapter 6: This chapter offers a set of conclusive statements about the general findings of the study. These are as follows:

a) Students developed content knowledge about health literacy issues, especially related to drug use, through their engagement with the game.

b) Students perceived the game as valuable because it addressed critical issues that they face in everyday life, and which are not addressed through formal education.

c) Students found the content scenarios personally meaningful and interesting, although repetitive in some chapters.

d) Students experienced a learning curve but in the end became comfortable in navigating through the game, enjoying its design features.

e) Students had an increased motivation to engage in the activities probably attributed to the novelty of technology, collaboration and activities.

f) The game provided opportunities for students to engage in collaborative decision-making based on authentic scenarios and data, which in turn supported their engagement in negotiating their understandings with their peers.

g) The game provided limited opportunities of ideas and content negotiation due to the lack of the students' prior knowledge on health issues and the close-ended format of the majority of the challenges.

h) The game provided opportunities for social interaction and collaborative work. These findings point to a set of recommendations for policy, curriculum development and game design, which are offered in the last section of the dissertation.

The dissertation concludes with 3 main recommendation for further research that:

a) Exemplifies the theoretical aspects and the characteristics of design frameworks associated with learning through mobile videogames.

b) Characterizes rich and complex pedagogical practices that use videogames.

c) Speaks to the details of the processes by which students come to construct knowledge and develop skills through their engagement with mobile videogames, in both formal and informal contexts.

2. Literature Review

2.1. Health Literacy, Mobile Learning and Games

2.1.1. Health Literacy in a Civic Context

A traditional promotion of health literacy and sexuality education was focused on the communication of medical related information, to individuals isolated from the wider socio-cultural context and from peers interaction (Hernandez, 2013; Hieftje, Duncan, & Fiellin, 2014; Hill, 2004; Lesta, Lazarus, & Essén, 2008). Such a conservative approach, focused on personal health factors and individual lifestyles and behavior, led to a health literacy crisis in the US. At the beginning of the millennia, only 12% of US citizens demonstrated a good understanding of health management and literacy skills (Kutner, Greenberg, Jin, & Paulsen, 2006; Xie, 2011).

These shortfalls quickly forced relevant stakeholders and practitioners to revisit the theory and practice around health literacy and prioritize the widening of the provision of capacity building initiatives in health literacy (Mogford, Gould, & Devoght, 2010; Xie, 2011). The U.S. Department of Health and Human Services, came in 2000, to define health literacy as the nexus of access to and understanding of health information, and the ability to take a suitable decision (U.S. Department of Health and Human Services, 2000; Xie, 2011). Nevertheless, limitations and challenges in the promotion of health literacy were still apparent among young teens. Information on addictions, nutrition habits, and sexuality issues remained detached from the context they were evolving, the community, and the wider society. Eleven years later, the U.S. Department of Health and Human

Services upgraded its health literacy definition placing a strong focus on the equipment of the individual with health literacy skills, not only to protect itself but also the community (Ioannou et al., 2014). In the last few years, the rapid advancement of information and communication technologies and the revival of the concept of citizenship, and civic engagement, commanded the evolution of a health literacy definition, as an integral part of civic education. Such a progress came in a more holistic approach, where skills for information access, communication, interaction and decision-making would become central to its provision (Hernandez, 2013; Ioannou et al., 2014). The World Health Organization set the framework of the latest progress in health literacy theory and practice, by providing an updated and more inclusive definition in 2013:

> Health Literacy has been defined as the set of the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health. By improving people's access to health information and their capacity to use it effectively, health literacy is critical to empowerment… Health education is achieved, therefore, through methods that go beyond information diffusion and entail interaction, participation and critical analysis. (World Health Organization)

As the priorities within the health literacy provision changed, the pedagogical and educational mode remained fragmented, failing to meet the needs of networked, connected and informed citizens (Xie, 2011). Health literacy is potentially an empowering aspect of citizens and community where they can influence and manage health risk related norms and habits, since, health literacy is a medium for "social and human development" (Hernandez, 2013). Health literacy provision should become participatory, citizen-centered and collaborative, beyond the educational formal settings in the era of

sophisticated, mobile and personalized information and communication technologies (Institute of Medicine, 2009; Oh, Rizo, Enkin, & Jadad, 2005; Xie, 2011).

It becomes apparent that active participation, interaction and decision-making practice on health issues needs to be developed through the use of real-life cases and training environments. Such environments should promote networking, negotiation, advocacy, research, information management and visioning to bring change to a community or a wider social and cultural environment. Therefore, students are expected to develop their capacity to contextualize knowledge, become "promotion agents", and understand the reciprocal path of influence, between the society and individual, through collaboration and critical thinking (Ioannou et al., 2014).

Nevertheless, health literacy promotion and healthy lifestyles shift, lack motivation, access opportunities, space and time, inadequate content and transmission mediums, and demand the restructuring of health literacy provision process (Arnab et al., 2013; Baert, Gorus, Mets, Geerts, & Bautmans, 2011). ICT can be deployed to challenge these obstacles offering the flexibility, adaptability, and accessibility for citizens to engage in health literacy initiatives (DeSmet et al., 2014). Nevertheless, plain learning platforms, which transmit knowledge, provide some form of communication, have limited opportunities for experimentation and contextualization, and require a hardware station in a given location are demotive for users (Miller et al., 2013; Sitzmann, 2011; Wouters, Van Nimwegen, Van Oostendorp, & Van Der Spek, 2013; McCallum, 2012). The limitations and gaps of mainstream ICT is suggested to be filled by the design, development and promotion of mobile videogames (Arnab et al., 2013; Miller et al., 2013; Olson, 2010). The use of mobile videogames can promote a customized, real-life based education where communication,

negotiation and decision-making can take place at real time conditions, and skills can be visibly transferable to the actual communal domain (Hernandez, 2013; Miller et al., 2013).

Youth is highly motivated to be engaged in health literacy environments that provide opportunities for creativity, networking, collaboration and real experiences of civic engagement (Bennett, 2008). As discussed, mobile videogames are pioneer learning media that are highly effective in attracting users, simulate real-life conditions, promote collaborative and negotiated decision-making, and peer support (Thinking, 2012). More importantly, as Kahne et al. (2013) discuss, the intended access of youth in such media, their interaction with health-related content, their engagement in debates and negotiations, and their communication with other users result in the increase of their interest and engagement with the public outside cyberspace (Kahne et al. 2013). Youth involvement in such contexts improves their skills and characteristics, essential for civic engagement, such as networking, communication, critical thinking, and respect for others (Ito et al., 2009; Jenkins et al. 2007). Furthermore, browsing in such virtual environments helps young adults to realize how the quality of their own life is interconnected with other citizens, and the social and cultural environment that surrounds them. Such a conceptualization on behalf of the youth also empowers its attachment to collaborative practices (i.e., of mutual understanding) and motivates further engagement in the public domain (Biesta et al., 2009; Kahne, 2008). Contemporary young teens are being socialized, educated and evolve through digital environments and/or real-life contexts (Erentaitė et al., 2012; Hoffman &Thomson, 2009).

Health literacy becomes influential and attractive if it is offered through mobile videogames, however, it is essential that their pedagogic approach moves away from the traditional top-down transmission of knowledge, which includes limited autonomy, constant assessment and fragmented

interaction among students. Researchers make particular references to the importance of simulations and role-playing in games as a process of developing civic skills and characteristics, through in-game decision-making, networking with other players and collaboratively debating on the next moves (Raphael et al., 2010; Kahne, 2008). Games provide multiple ways of learning, giving meaning to complex (civic) ecosystems in an authentically collaborative and networked manner (Koutromanos & Avraamidou, 2014), baring affordances which are directly linked with the mode of learning and engagement of the contemporary youth (Bennett et al. 2009; Montgomery et al. 2004). Games can fully support the basic features that should constitute the design and development of an effective and influential health literacy initiative for youth, such as interaction with peers, design, develop and share their own creations, networking, critical thinking, decision-making, problem solving, and meaningful learning (Montgomery et al. 2004).

In the following chapters, I discuss the learning modes, pedagogies, and technical characteristics of mobile videogames, where its basic features, attributes and affordances are directly matched with the learning objectives of the health literacy.

Thus, the following analysis of health literacy will mostly be focused on the necessary pedagogical and learning styles that better support the advancement of basic skills. Such skills include critical thinking to assess, analyze and reflect on information and practices, organizational skills to develop networks and collaborations, communication and negotiation skills, problem solving, decision-making and strategizing, and visioning skills to intervene in the transformations of the public domain (Erentait et al., 2012; McLeod, 2000; Montgomery et al., 2004).

2.1.2. Mobile Learning Games for Health Literacy

Mobile learning as an educational model, encompasses the learning process which takes place with the use of a mobile device, such as tablets, smartphones, and laptops (Koutromanos & Avraamidou, 2014; Kukulska-Hulme & Traxler, 2005; Quinn, 2000). The constant evolution of devices, software and applications are expanding the usability and potentials of mobile learning at all levels of a globalized world (Park, 2011). Mobile learning goes beyond the mechanical use and utilization of mobile devices affordances; it's, more importantly, about the design of new learning environments, modes of knowledge design and delivery, and learning opportunities (Peters, 2007; Walker, 2006). The mobile nature of the practice and its tools, as well as the flexibility in its usage, secure the timeless and limitless access to information, its management, transformation and multiplication, making the learning process challenging, attractive and appealing (Kim, Mims & Holmes, 2006). These potentials are mainstreaming the integration of mobile learning as an effective education practice, blending both formal and non-formal educational environments (Kiger, Herro, Prunty,2012; Looi, Seow, Zhang, So, Chen and Wong, 2010; Traxler, 2007).

For students, the use of mobile devices in learning process is an escape gate from traditional forms of education, walls, time-schedules, framed curriculum, controlled communication and uncomfortable chairs, since they can transfer their learning process to a customized environment with contextualized content and visuals, open communication, collaboration and experimentation in an endless cyberspace, all from the comfort of their chosen location (Olson, 2010; Shin, Norris, & Soloway, 2011). However, despite the attractiveness of mobile learning and the potentials it generates, there has been limited focus on developing effective educational interventions, since relevant stakeholders prioritize the technical advancement of tools and applications, over effective

skills acquisition (Kearney, Schuck, Burden, & Aubusson, 2012). Mobile learning practitioners, both in formal and non-formal education, become familiar, with the pillars that constitute mobile learning as effective and attractive, which are "authenticity, collaboration and personalization" in a contextualized format (Kearney et al., 2012). To unfold the potentials of mobile learning for a targeted audience, in a specific theme, the commitment and expertise from the learning provider, the instructional designer, and the facilitator are essential (Kiger et al. 2012). The space, time, and content boundaries of the traditional learning process must be replaced by the flexibility, connectives, and effectiveness of mobile learning in engaging young teens especially, and upgrading their skills and knowledge (Su & Cheng, 2013; Traxler 2009).

Despite the recent progresses in incorporating health literacy initiatives in schools, in both formal and non-formal mode, and the willingness of decision makers to support such initiatives, the health literacy of the youth remains fragmented (Ioannou et al., 2014; Lesta et al. 2008; Kickbusch, 2004). This shortfall has mainly resulted from the failure of health literacy stakeholders to realize that "the contemporary experience of growing up in an unprecedentedly networked and interactive media world has led many young citizens to develop learning styles that also do not fit with many of the methods used in civic education", including health literacy (Bennett et al., 2009, p.107). Such deficits are observed both within and outside the formal educational system, where despite the introduction of technology in the classroom, the efforts of some form of contextualization, and the extended use of websites and social media by civic stakeholders, the attraction of interested learners is diminishing (Bimber, Flanagin, & Stohl, 2005). Such interventions have failed, as they have a top-down approach (absence of youth in its design and development) and are directed by mainstream institutions, such as schools and public services (Bimber et al.,2005). The vast majority of these interventions are also

characterized by minimal interactivity, limited opportunities for the creation and sharing of resources, and do not set the environment for real-time, contextual collaboration and communication between peers (Bimber et al., 2005). In the face of such negative progresses, it is gradually becoming clear to health literacy stakeholders, that the civic knowledge diffusion for citizens has to progress to more interactive delivery modes with the active involvement of young students and citizens in "collaborative problem-solving activities" (Bennett et al., 2009, p.108) and whereby independent interaction and intervention with and within online environments will be maximized (Coleman, 2008).

Building on the previous argumentation, and with the deployment of mobile learning practices, the perceived "dichotomy" of formal and non-formal learning can overlap (Beale, 2006; Looi et al., 2010; Luckin, 2010; Sharples, 2006). The extended use of mobile devices by students should drive teachers and education stakeholders to design and provide learning environments which give the flexibility to students to navigate beyond the formal school curriculum, build their 21st century skills (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2007) and, at the same time, facilitate their learning and interaction.

Therefore, the current challenge of health literacy is primarily how to merge the newly networked world of humans with education initiatives, which will attract the participation of new learners, and empower and increase their engagement in the public domain (Bimber et al., 2005). In the current research, the focus was to design and implement a learning intervention based on a health literacy game, which gave the opportunity to groups of lower secondary education students to personalize the game characters, collaborate, take decisions and contextualize experimentation in an afterschool setting. In the following chapters, how mobile videogames can fulfil the basic

requirements to make health literacy initiatives attractive, relevant, and influential for students and their peers (Amiel & Reeves, 2008; Kahne, 2008) is discussed extensively.

Some of the primary shortfalls of health literacy education have been its distance from real-life conditions and its strong focus on "lectures, multiple-choice tests, names and dates" (Schugurensky & Myers, 2008, p.76). Therefore, it is imperative that the health literacy learning objectives should be put in context. Such a progress will simplify the complexity of issues addressed by health education (Kerr, 1999), give meaning to the multidimensional skills under construction, and support the very essence of health literacy, which is to address real health risks in a critical and collaborative manner.

Contextualized health literacy maximizes the motivation and interest of young citizens to be engaged "creatively, critically and analytically" (Komalasari, 2009, p. 261). Moreover, the complexity of health challenges demands the development of skills and characteristics such as collaboration and decision-making skills of young teens (Bo Xie, 2011; Komalasari, 2009), which can be met through the use of educational mobile videogames (Fuchslocher et al., 2011; Miller et al., 2013; Olson, 2010).

Mobile videogames give the opportunity of choice to the users on when and for how long to interact; they are attractive environments due to their playful and fancy design, the story-line, the challenges of problem solving, and the direct interaction with peers and situations that the user can identify with (Miller et al., 2013). Particularly, the opportunities for collaboration, debate and decision-making on simulations of real-life health risks and challenges are part of an effective learning process. This effectiveness is maximized if mobile videogame-based initiatives are promoted

in a blended manner between students' autonomy and school teachers' support and encouragement (Arnab et al., 2013).

For students, mobile videogames can provide a secure environment where they can discuss, negotiate, take decisions and act on matters of sexuality, eating habits, alcohol and drugs, where they would not ordinarily be tested in real-life. In mobile videogames students can test their health boundaries, take conscious, non-socially accepted decisions and interact with characters not approved by their parents, with all harmful impacts hitting their game avatar (Olson, 2010; Sandberg, Maris, & de Geus, 2011). In this process, young teens can view the abovementioned framework as attractive and motivational to play educational games, where the visualization of the outcomes, and the indirect acquisition of knowledge and skills will be the reward (Miller et al., 2013).

Collaborative learning and negotiated play methods through mobile videogames have been transparent in all of the above analyses on the promotion of health literacy. In fact, the promotion of health literacy initiatives based on collaboration and interaction in mobile environments is an essential element of its success (Xie & Jaeger, 2008). As Xie (2011) argues, this form of learning has a direct impact on shifting health lifestyle, and at the same time, building the capacity of users in decision-making, a skill which constitutes a vital indicator for the health literacy levels of a citizen.

2.1.3. Social Constructivism in Mobile videogames for Health Literacy

Social constructivism is discussed in this chapter in the context of collaborative mobile videogames; how this pedagogical approach evolved through the use of mobile devices and innovative software, fully applicable and desirable for the promotion of health literacy. As a pedagogical model, social constructivism places its emphasis on a learning development on the interactions of the ecosystem

and all parameters that constitute it, where the social interaction of the learner with the people of its (real or virtual) community constitute the primary source of knowledge and skills development (Mishra, 2014; Kiger et al., 2012; Vygotsky, 1986). In an ecosystem where a learner interacts, negotiates and communicates, there are various perceptions, truths and understandings, therefore, the science of pedagogy validates the construction of a variety of realities of students, given that they are built on sound argumentation and reason. In this way, students have an active role in the learning process. The teacher becomes a facilitator who guides the implementation of activities that foster the interaction of learners and supports an independent construction of knowledge. The use of artefacts and symbolic visuals are of paramount importance to social constructivism since the interaction and reflection of the students with such elements,-constructs knowledge (Vrasidas, Zembylas & Petrou, 2005). In the current literature and research on the field, mobile videogames are considered to be one of the most compatible and influential tools to promote a social constructivist approach in learning (Hense & Mandl, 2014; Arnab et al., 2013; Ray et al., 2013).

Knowledge and skills development in mobile videogames are associated with interaction, a collective construction of learning objects and perceptions, information sharing and negotiation, and ongoing collaboration. Through these kind of approaches, students are provided with opportunities to apply knowledge to real-life experiences, and foremost knowledge development becomes meaningful and motivational (Sharples, Corlett, & Westmancott, 2002; Spence, Hess, McDonald, & Sheehan, 2009). A central element of the social constructivist approach is collaborative learning, which is a primary affordance of mobile videogames, as it can rapidly support the connectivity and communication between peers, exchange information and construction of collective knowledge (Kearney et al., 2012; Naismith, Lonsdale, Vavoula, & Sharples, 2004). Learning through

collaboration has been effective in a series of social sciences where learners acquire content knowledge and applicable skills (including those attached to health literacy) building to empower their active participation in the civic domain, take sound decisions and influence change (Ray et al., 2013; Kiger et al.,2012; Bo Xie, 2011; Tutty & Klein, 2008; van Joolingen, de Jong, Lazonder, Savelsbergh, & Manlove, 2005).Collaboration, in a social constructivist context, has strong elements of negotiations and meaning sharing, which require a set of skills to be beneficial as a learning process (Mishra, 2014). Therefore, the engagement of students in a game based on a collaborative mode is defined in the context of current research as negotiated play, and such interaction is a central part of this investigation.

Game users may group up to function in a constantly changing complex environment, where they have to be creative, innovative, flexible and adaptable, characteristics which favour the social constructivist approach (Hense & Mandl, 2014; Powell & Kalina, 2009). Additionally, the authenticity of the game environment, the contextualization of the narrative and the autonomous interaction in terms of choice, space and time, empowers the learning process (Joosten, 2010; Ray et al., 2013; Su & Cheng, 2013), which is characterized by its social constructivist approach (Bruner, 1993).

Now we will attempt to align the social constructivist approach and mobile videogames with health literacy, as an influential, effective and motivational learning nexus. It is argued that health literacy is closely associated with the constructivist approach, in which learners construct knowledge by interacting and negotiating with the ecosystem (context) in which they function (including other persons, institutions, norms, beliefs and cultures) (Bo Xie, 2011; Komalasari, 2009). The current research emphasizes the mobile virtual environments that promote collaboration and negotiation of

meanings, and constitute a very good example of constructionism, in which they shift knowledge development from the person to the group, focusing on the experiences and skills developed when participating and interacting within it (Bers, 2008; Blumberg et al. 2013). In this context, it can be argued that the social constructivist approach is fully compatible with the pedagogical framework deployed for the promotion of health literacy skills through mobile videogames (i.e., collaboration, interaction, experimentation) (Bers, 2008; Hernandez, 2013).

Students are extremely critical in hierarchical modes of knowledge transmission (Bennett, 2008), where their interaction with cyberspace provides alternative forms of expressions and development of knowledge, on a peer-to-peer communication, networking and collaborative action (Bennett et al. 2009). Therefore, the pedagogical focus of health literacy for youth has to be transferred to online spaces, and secure a direct interaction and creation of various formats of content (text, videos, visuals), communication, negotiations, freedom of expression, action, and collaboration, in a globalized context (Bennett et al., 2009; Bennett, 2008). Such virtual environments are easily accessible by young teens for their socialization, in contrast to distant places or public spaces, where adults are more keen to have open access (Boyd, 2014).

Montgomery et al. (2004) provide a list with the basic requirements that mobile videogames have to encompass to attract youth and empower engagement in health literacy activities, including a special reference to games. Those requirements include the integration of cases, tasks, and content, directly related to the interests of youth, an online environment to reflect the language and visuals of youth culture, provide tools for production and reproduction, reflection and dissemination of content, and to provide autonomy for new styles or modes of interaction and learning (Bennett et al., 2009; Montgomery et al., 2004). Virtual environments also give the opportunity to youth to acquire

knowledge through its engagement with real situations and existing problems (Lawy & Biesta, 2006) that may either take place in cyberspace or be simulated in it (i.e., be involved in online campaigns or develop virtual pressure groups through a games environment). The spectrum of possible simulations and motivations for engagement and contextualization that online games bring to health literacy alters such mediums as highly effective for building the skills of the youth (Raphael et al., 2010).

Mobile videogames provide the opportunity to a wider spectrum of youth to be engaged in a health literacy overarching the barriers of gender inequalities, xenophobia and marginalization of people with disabilities (Bell, 2005; Miller et al., 2013), without, however, neglecting the possible limitations of youth that due to issues of financial affordability, political conditions and cultural barriers may still be excluded from accessing such opportunities. At this point, it is important to make a special reference to how gender bias plays out in games. Mobile videogames, designed and developed in the current sociocultural environment, focus on competition and antagonism between players, a characteristic which is aligned mostly on how societies see and breed boys. Therefore, we expect boys to play games and games to attract boys. In this way, the games' development ecosystem ignores girls as potential gamers, while, at the same time, perpetuating the dominant norms about boys' characteristics (Miller et al., 2013).

Originating from the literature context above, this study aims to contribute to the literature by examining, through a qualitative research, the nature of interactions of lower secondary education students', be means of their engagement with a mobile videogame for health literacy in a period of six weeks.

2.2. Mobile Videogames: Design and Affordances

2.2.1. Gamification of Learning

In contemporary times, play and the gamification process is primarily expressed through digital environments, particularly, digital games (Amory, 2007). The research community has a long standing interest in the interconnection of games and learning, and especially in how games stimulate motivation to be engaged in activities that directly or indirectly promote the development of skills and knowledge (Moreno-Ger et al., 2008; Vygotsky, 1980; Oliver and Carr, 2009; Rieber, 1996; Ke, 2009; Wilson, Bedwell, Lazzara, Salas, Burke, Estock & Conkey, 2009;). As Amory (2007) notes, the primary features of games, such as "visualization, experimentation, and creativity", affect, on multiple levels, the learning process of the gamer with a particular impact on the empowerment of skills linked with critical thinking and problem solving (Amory, 2007, p. 52).

In various forms, games are part of everyday life of every human (Lenhart, Kahne, Middaugh, Macgill, Evans & Vitak, 2008). Although the major goal of games is pleasure, games have always been part of diverse fields, such as the army, politics, architecture, education, and marketing (Muntean, 2011; Sicart, 2008). A central and common element of these diverse penetrations games was the learning potentials they offer to the users (linked among others with capacity building, and information acquisition and sharing) (Muntean, 2011). The implementation of games or elements of games in diverse settings, not directly related to the play process, for purposes of learning, and marketing, has been recently ladled with the term *gamification* (Deterding et al., 2011; Stott & Neustaedter, 2013). Gamification, for learning, has been extensively used to motivate users to be engaged in the play process and increase the learning benefits of playing by deploying basic game features, such as contextualization of engagement, challenges, collaboration, freedom of decision-

making and experimentation (Deterding et al., 2011; Hamari, Koivisto & Sarsa, 2014; Moreno-Ger, Burgos, Martínez-Ortiz, Sierra & Fernández-Manjón, 2008; Muntean, 2011).

Games, as learning environments, evolved rapidly during the last decades, along with the constructivist perspective on education (Cunningham& Duffy, 1996), the rapid spread of the web, social networks and mobile devices (Martin, Diaz, Sancristobal, Gil, Castro & Peire, 2011). At the same time, education stakeholders try to diversify the learning process from the "factory model of education in which each student does the same thing at the same time" (Dickey, 2006, p.249). Therefore, the urge to develop flexible and accessible learning, needs-based environments, and to encompass various modes, models and forms of knowledge development, led to the development of a variety of digital game formats.

Additionally, games have multiplied their popularity among the education stakeholders due to two major affordances: their ability to maximize intrinsic motivation for engagement in a learning process (Habgood, 2007; Martin et al. 2011; Whitton, 2011), and the empowerment of the learning process through visible accomplishments in contextualized educational environments (Whitton, 2011; Vos, van der Meijden & Denessen, 2011). Games are motivational because they provide the opportunity to the user to preserve a level of autonomy in its choices and to act in a comprehensive and contextualized environment (Kirriemuir & McFarlane, 2004). Other researchers propose other factors that could potentially contribute to the motivation to engage in game play for learning, such as the tasks and pleasure of accomplishment (Sherry, Lucas, Greenberg & Lachlan, 2006; Przybylski, Rigby & Ryan, 2010), the comprehension and interactivity of the game structure, the attractiveness of activities and game environment (Flow Theory, Csikszentmihalyi, 1990), the attachment of the player with the game story, and the perceived learning benefits (Habgood, 2007; Whitton, 2011).

Some also make specific references to fantasy (Sherry et al. 2006; Wilson et al. 2009) and mystery (Wilson et al. 2009) as motivational features of games, attributes that are linked to the game play environment and narrative. Overall, games appear to be more engaging and motivational than traditional modes and environments of learning (Tüzün, Yılmaz-Soylu, Karakuş, İnal & Kızılkaya, 2009).

Annetta (2010) in Blumberg et al. (2013), distinguishes digital games into four major categories: (a) the serious games; (b) serious educational games; (c) simulations; and, (d) virtual worlds. Serious games and serious educational games are overlapping categories in which the former refers to (vocational, extra-curricular) training, and the latter is linked directly with an academic/educational content. Simulations include basic game characteristics but do not have the feature of scoring (achievement measurement), and in virtual worlds, networking is prioritized over other games' features (i.e., content). In the context of the current research, we refer primarily to serious games, as they appear to be more compatible with the envisioned learning objectives of the proposed civic education mode. Specifically, "serious games perspective are structured to develop competence via task completion, provide choice to allow for player autonomy, and connect relevant goals to factors, such as personal values that exist outside of the gaming environment" (Blumberg et al., 2013, p.337). Serious games (in contrast to other types of games) also appear to preserve the characteristics that make them motivational for learners, such as entertainment, task orientation and the challenge to empower and deploy a variety of skills over the game course (Blumberg et al., 2013; Charsky, 2010). Nevertheless, throughout this research report the term mobile videogames was selected over other terms, such as serious games, as it is the term mainly used by the design and development team of the *PlayForward: Elm City Stories mobile videogame* (Fiellin et al., 2016;

Montanaro, et. Al., 2015). Moreover, as a term, "serious games" is more related to formal educational contexts (DeSmet, Van Ryckeghem, Compernolle, Baranowski, Thompson, Crombez, Poels, Van Lippevelde, Bastiaensens, Van Cleemput, & Vandebosch, 2014; Gibson, 2012).

The learning process in games involves the development of skills, such as critical thinking, problem solving and analytical skills (overlapping with the learning objectives of health literacy), through a "trial and error process" (Vos, 2011, p.128), making choices for the next steps, and addressing contextualized challenges (Gee, 2003; McFarlane, Sparrowhawk & Heald, 2002). In addition, learners in game environments move beyond the memorization of content and information, and are engaged in quality learning, which is a process of synthesizing new concepts, interconnecting old and new knowledge, developing a meta-cognition of their interaction in the game environment, transferring their new knowledge and skills in new ecosystems, and reusing it in new challenges (Biggs, Kember & Leung, 2001; Laird, Shoup, Kuh & Schwarz, 2008; Marton & Säljö, 1976).

In a similar approach, Stott and Neustaedter (2013) discuss the attractiveness of games as learning environments among young users (Stott & Neustaedter, 2013). They identified four main features of games that are attractive as learning tools; namely, the availability of rapid feedback, the freedom to fail, progression in accomplishments, and storytelling. The new element they have added from other researchers referred above, is "rapid feedback", which reflects the direct, real-time collaborative and networked framework of online games. The potential to provide or receive feedback from peers or from the game itself grants users the confidence and guidance to navigate in the game, but also to develop collaborative skills in the learning process (Amiel & Reeves, 2008; Collins & Halverson, 2010; Moreno-Geret al., 2008; O'Neil, Wainess & Baker, 2005). Also, the freedom of fail provides a comfort to users to navigate freely in a game environment, and through experimentation,

analysis and metacognition to develop new solutions and concepts to overcome challenges: a feature that is typically absent from mainstream learning environments (Gee, 2008; Salen, 2008; Stott & Neustaedter,2013).

Progression within the game is also an attractive and educational element, which supports the development and implementation of skills in different contexts (Kapp, 2012). Finally, storytelling is another element of games that positively impacts the learning process, while it preserves the attraction of the user to the gaming/learning process (Kapp, 2012). Storytelling, which is directly linked with contextualization, gives meaning to the gaming experience, and provides gamers with an attachment of experiences to real-life, while it provides the opportunity to users to visualize their skills, being implemented in real-lifelike environments (Clark & Rossiter, 2008; Salen, 2008; Stott & Neustaedter,2013). To sum-up on the attractions and the effects of games, the gaming environment stimulates through, collaboration, contextual navigation, free decision-making and negotiation, experimentation and problem solving, the ability of gamers to think critically and assess challenges and problems, discuss and network, develop and synthesize concepts, ideas and praxis, and strategize collaboratively (Collins & Halverson, 2010; Robertson & Howells, 2008).

Mapping the basic features, components, attractions and affordances that constitute the design and development of mobile games, it is strongly argued that they are in full compatibility with the learning mode and objectives of the contemporary health literacy framework. Virtual environments, such as games, motivate gamers to generate and develop the skills and, moreover, youth is introduced to basic health lifestyle principles of collective and autonomous action and governance for the common good (Boyd, 2014; Glover, 2012; Kahne, 2008; Montgomery et al., 2004).

As is evident in the above, there are three major features of games that positively influence the health literacy evolution. These are: the opportunity to make logical choices in contextualized settings (including collaborative decision-making), the process of gaming (linked with experimentation, critical thinking and problem solving), (McGonigal, 2011; O'Neil et al., 2005) and the trialing to develop reason (associated with attaching meaning and contextualizing actions) (O'Neil et al., 2005; Stokes, 2012). Progressing through games, users are scaffolding skills, characteristics and conceptions about the outer worlds, which will, potentially, increase their civic education levels and to some extent maximize, make more efficient and direct their engagement in the public domain (Squire, 2006).

2.2.2. Decision-Making and Mobile videogames

Research suggests that collaborative learning is much more effective in bringing high learning outcomes for students, rather than a traditional education process which has a focus on the individual student or on competition (de Freitas & Oliver, 2006; Hummel, Paas, & Koper, 2006; Skon, Johnson, & Johnson, 1981). Particularly, task-oriented collaborative and negotiated learning is developed based on the process of problem solving, critical thinking and decision-making (Perkins 1999). In small learners groups, as in the case of the current research, where direct social interaction and information sharing are ongoing, a shared decision-making process and, to some extent, skills development are primary, positive contributions to collaborative learning (Lund, 1992). Moreover, it is vital for students to learn how to function, interact and take decisions in groups. Groups often appear to take more valid decisions than individuals, as they have access to a wider range of information, errors are identified, discussed and addressed more regularly, and groups are bigger tanks of skills and knowledge (Supovitz, & Tognatta, 2013; Hill, 1982)

Decision-making is one of the most important skills required at all levels of everyday life for everyone, particularly for active citizens, and it is even more important considering that our lives are practically defined by our decisions (Baysal, 2009). Decision-making is a skill to be developed (Parker, & Jarolimek, 1997; Smith, 1998), where participants in such a process have to assess options based on available information and existing conditions to take a decision for an action (Galotti, 2002). Therefore, an "effective decision-making ability is closely linked with creative and critical thinking abilities" (Baysal, 2009, p.78), abilities which, as analyzed in the previous chapters, are closely associated with health literacy, mobile videogames and a social constructivist approach (Hernandez, 2013; Powell, & Kalina, 2009; Whitton, & Hollins, 2008). In the context of social constructivist pedagogical interventions, especially, like that which we will be seeing in this research, learners are required to be active participants in knowledge development, negotiation and sharing, and to interact directly with their environment and peers (Brooks & Brooks, 1993). Consequently, for any learning initiative targeting a civic real-life transferability of knowledge and skills, such as health literacy, critical thinking, negotiation and decision-making, should be primary learning objectives and expected outcomes (Allen, 2000; Baysal, 2009; McBride & Ping Xiang, 2004).

The empowerment of citizens with decision-making skills is a key indicator for high levels of health literacy (Xie, 2011), as citizens need to evaluate and take decisions on complex and complicated health and well-being dilemmas in their day to day life (Miller, Pater, & Mynatt, 2013). Apparently, such a process requires not only a basic comprehension of technical and information-oriented knowledge and content of an issue, but also the skills to contextualize the knowledge available and make the right path of choices and decision to support ourselves and our wired community (Nicolaou, Korfiatis, Evagorou, & Constantinou, 2009). Moreover, for an individual to

enter a decision-making process, it must be on a volunteer basis, be adaptable and flexible to new ideas and knowledge, and ready to reach to an agreement/resolution (McBride & Ping Xiang, 2003). Current forms of learning, especially within formal education settings, lack the approaches, activities and-objectives to foster skills associated with decision-making (Nicolaou et al., 2009). It is important that such skills take place in authentic environments attached to actual problems, where students will understand the contextualization of a decision-making process, which is associated with specific conditions at a given time in a given environment, and that this decision may change in a different context. Learning in such an environment will assist students in transferring their skills and adapting them to real unaccustomed civic domains (Nicolaou et al., 2009).

As noted above, the willingness to enter decision-making is also a critical parameter to develop such skills (Halpern-Felsher & Cauffman 2001), and this notion has been a major aspect of invitation for participants in the current case study research. In order to achieve this, learning environments should offer multiple choice in interaction and engagement with the game ecosystem and peers, the learning process in terms of time and space, self and group regulation, and to provide opportunities for new discoveries and challenges (Olson, 2010). Such a context is offered by mobile videogames (DeSmet et al., 2014; Linehan, Lawson, Doughty & Kirman, 2009), where its appropriateness for fostering decision-making skills will be discussed in the following paragraphs.

Instructional designs and implementations, and targeting decision-making skills development should consider teachers or educational staff as facilitators, rather than as being totally absent from the process (McBride & Ping Xiang, 2004) or preserving their top-down traditional role in teaching (Nicolaou et al., 2009). It is suggested that teachers or educational staff should be supportive in providing content related knowledge to facilitate a valid decision-making process and to regularly

encourage the active participation, in terms of decision-making processes, of all group members in all groups (McBride &Ping Xiang, 2004; Turner, 1996). Specifically, Nicolaou et al., 2009 (2009) suggest that learning designs should develope inquiry-based scaffolded learning environments that are considered more appropriate for thoughtful decisions and skills to emerge. Such a progress in the design of learning environments would result in the empowerment and the appropriate capacity building of students to act in the public domain and achieve change in mainstream socio-cultural norms and beliefs (Jimenez-Aleixandre & Pereiro-Munoz 2005; NAAEE 2000). This approach constitutes one of the primary objectives of health literacy promotion (Ioannou et al., 2014).

An additional challenge in the upgrading decision-making skills of learners is their limited exposure to complex environments which offer alternative paths to solutions, and where learners should deploy a reasoning of elimination or selection of an option based on well-informed indicators (Howse, Best, & Stone 2003). To recognize the importance of a coherent sequence of critical thinking and path choices in a learning interactive? environment is to appreciate the value of "thoughtful decision-making", an approach that has been absent from the majority of learning "agendas". Moreover, "the role of thoughtful decision-making might contribute to a larger construct relating to the creation or consideration of thoughtful learning environments" (McBride & Xiang, 2004, p. 337). As already mentioned, such environments are the mobile videogames, including the *PlayForward: Elm City Stories* mobile videogame. Fostering collaborative learning and thoughtful decision-making constitutes one of the primary learning affordances of mobile videogames, as concluded from the fusion of the approaches above on decision-making (McBride & Xiang, 2004; Ray et al., 2013; Xie, 2011).

Primarily, mobile videogames "can utilize the inherent motivation demonstrated by game players in order to teach skills that are of immediate practical benefit… and transfer game skills to real world activities" (Linehan et al., 2009, p.20), which, as suggested above, is considered to be the most appropriate learning approach to advance decision-making skills. It is important for a learning oriented mobile videogame to validate the transferability of the decision-making conditions of the game environment to the real environment. It has been argued that games which promote thoughtful decision-making in a collaborative manner have, as a distinctive attribute, the assessment, discussion, reflection on errors or shortfalls of the decision-making process, another vital learning process (Linehan et al., 2009). For this interaction to be empowered, the presence of a facilitator to provide informed feedback, promote participation of all, and suggest deployment of skills, is extremely important in collaborative mobile videogame, too (Kiger et al., 2012). Moreover, the group should gradually develop the ability to manage time, information, collective knowledge and skills, an understanding of the game environment workings, and to envision the impact of choices in order to take the most appropriate decisions (Kerr & Tindale, 2004). It has been evident through research that a collective decision-making process has to be tough in order to be socially beneficial and to have a positive impact on the wider community (Linehan et al., 2009), as health literacy initiatives intend.

This approach is mostly associated with the notion of non-formal learning as a contextualized process, which is adjusted to real-life simulations, taking place outside the formal curriculum, and based on multiple interactions with the ecosystem (peers, game visuals and content, game play environment) (Aubusson, Griffin & Kearney, 2012; Clough, Jones, McAndrew & Scanlon, 2008; Davies, 1998; Huang & Chen, 2013; Janssen, Berlanga & Koper, 2011; Koutromanos & Avraamidou, 2014; Selwyn, 2007). Furthermore, non-formal learning, also referred to as social learning by Straub

(2009) is closely associated with basic motivational, educational and engaging features of games such as collaboration, experimentation, contextualization, creativity, self-pasted, autonomous, and skills development (Bandura, 2001; Chen & Bryer, 2012; Grummell, 2010; Straub, 2009). Specifically, for the purpose of the current research, non-formal education refers mainly to a learning process that occurs outside the formal curriculum, which, nevertheless has pre-defined learning objectives (the distinction from informal learning), is highly associated with a contextualized learning directly linked with skills development in fields such as health literacy, and is flexible, inclusive and needs-oriented. Non-formal education is provided in the context of thematic clubs by non-governmental organizations, or after-school programs and is directly connected with the wider community. Its format can take many shapes as it is mostly project-based, enriched with collaborative problem solving activities, and connected with-participants real-life environments (Kedrayate, 2012; Latchem, 2014; Xhafa, Fernandez, Daradoumis, Barolli, & Caballé, 2007).

The implementation of the *PlayForward: Elm City Stories* mobile videogame is situated within a non-formal education framework, taking place during after-school hours in technology labs, and within the presence of 2 facilitators (including myself), in the context of the school's newly founded Games' Club. The non-formal mode of accessing and delivering the mobile videogame for health literacy is compatible with its overall theoretical framework built on empowered citizens, collaborative action and boundary-less action and engagement. The choice of young teens to engage in the game came autonomously based on their own motivation to enter, play, collaborate and learn in the game, on an equal basis, beyond hierarchical structures (Lankshear & Knobel, 2011; Grummell, 2010; Schugurensky & Myers, 2008). More importantly, as many researchers have analyzed in the past decades, the mode and context of learning has to fully match the envisioned learning outcomes

and the learning styles of the learners (Coleman, 2008; Jenkins et al., 2007). In the case of health literacy for young teens, the expected outcomes are for learners to embrace basic civic principles and empower their skills to be effectively engaged in the public domain in order to bring change to health lifestyle. Consecutively, the delivery mode, the interaction with learning objects and peers, and the design of education initiatives must be based on a cooperative mode, freedom of choice and engagement, collective decision-making, and collaborative linear learning between learners and teachers. Moreover, learning has to become more networked and digitalized, as the preferred mode of learning for youth (Lankshear & Knobel, 2011), and be meaningful in the public domain (Bennett et al., 2009; Kahne, 2008; Campbell, 2005).

2.2.3. Educational Game Design and Development

In this section, primary parameters, premises and requirements for designing and developing a mobile videogame for health literacy will be discussed. A game which will encompass the features, affordances and content to make it motivational for play, support a quality learning process, and generate and empower the primary skills and characteristics of users. The chapter will conclude with the alignment of these affordances with the characteristics of the *PlayForward: Elm City Stories* game, and other research projects conducted with the use of this game.

Designers of online games must not only approach the game design process as if constructing artefacts, but as assembling a "social practice" (Amory, 2007, p. 67), or a social ecosystem. In this ecosystem, choices, characters, contexts, imagination/fantasy, and challenges, should interplay and interact between them and with the gamers, cultivating their game and learning experiences (Veermans & Cesareni, 2005).

Mobile videogames for health literacy must combine the provision of health-related information along with the development of relevant skills. Such an approach will contribute to a change in perceptions and habits that are considered risky for a healthy lifestyle in the society. Such a shift is envisioned to occur through flexible "modelling", contextualization and experimentation (Montanaro, Fiellin, Fakhouri, Kyriakides, & Duncan, 2015; Kato 2010) with an engagement of learners with the game environment and their peers (DeSmet et al., 2014; Sitzmann, 2011; Wouters et al. 2013)

There is an increasing complexity of social challenges in the world, such as the escalating detachment of youth from the civic domain, the shortfalls of sustainable development and increasing violent conflicts which are attached to health risks. These challenges demand the sophisticated design and development of digital health literacy initiatives that will equip and engage the youth in an efficient and positive manner in the globalized public domain (Stokes, 2012). Game design must depart from its strong focus on purely technological components, and incorporate an interdisciplinary approach including, instructional design, social sciences and visualization/communication attributes (Stokes, 2012). The game design for health literacy must intentionally nurture the skills and characteristics that the designer/stakeholder envisions to equip the learners/citizens, and provide the appropriate triggers to maximize their motivation to be engaged in the game play (Fiellin, Hieftje, Edelman, & Camenga, 2013; Raphael et al., 2010; Stokes, 2012).

There is a number of game designs, which Moreno-Ger et al. (2008) classify in three major categories: multimedia presentations, re-adjusted games with learning components from previous games, and games that are developed for specific learning objectives (Moreno-Ger et al., 2008). The multimedia presentations lack the entertainment aspect, and the re-adjusted games the specialized

learning objectives (Prensky, 2001). Having argued about the importance of attraction, motivation and quality of learning in a mobile videogame, along with a needs-based approach in design and development, the appropriate type of game to be developed is a new specialized (serious) game, that in balance its entertainment aspects (as attraction) and bring desirable learning objectives (Charsky, 2010).

Contemporary gamers will have fun managing a character, an institution or an ecosystem, collaborating with other gamers, with whom they will negotiate, exchange feedback, and share game-related resources. Gamers will progress in the game, developing their skills and giving a real-life context and meaning to them through their implementation in the game (Charsky, 2010). The attractiveness of the game and the quality of its internal learning process will be maximized with the elasticity of its rules (i.e., allow trial and error approaches), the multiple ways of being engaged in it (variety of available characters) (Raphael et al., 2010), as well as the multiple ways and paths of accomplishing tasks (Martin et al., 2011; Koster, 2005; Spiro, Feltovich, Jacobson & Coulson, 1991). Such an approach is compatible with the envisioned learning objectives in the context of health literacy, such as critical thinking, collaboration, freedom of choices and decision-making, analytical approaches and contextualization, since it can attract learners with diverse gaming preferences and learning modes (Stokes, 2012; Whitton, 2011; Page, 2008). Moreover, in the area of civic education and health literacy, researchers argue that the development of games, using contextualized content and targeted play mode, are more likely to motivate gamers to apply the skills they develop in the public domain (Raphael et al., 2010).

In what follows, the focus is on elements that encompass the social ecosystem of the game. The game mode should provide autonomy to the users to make choices through the game progression

based on critical and rational thinking, so that the games preserve their interest, but also develop their skills of synthesizing and analysing options in an autonomous manner (Whitton, 2011; Dickey, 2007). Choices are directly linked with the challenges that a game has to offer. The variety and complexity of challenges also contribute to both the attractiveness of the game and the quality of the learning process, as challenges define the skills needed to accomplish project tasks (Blumberg et al., 2013; Charsky, 2010).

Another important aspect of game design is the success level of triggering users imagination and fantasy, not only as an entertainment aspect but also as an educational one. Such a process will develop the ability of users to visualize and vision new social contexts and new forms of interaction. Therefore, the game must provide the potential to users to travel into the future or in a parallel present, and experience in a psychological way a new social ecosystem (Amory, 2007; Habgood, 2007). Game designers also associate fantasy with the narrative of the game (including the play environment and storytelling) (Dickey, 2006). The narrative also directly influences choices and challenges. A narrative, according to Dickey (2007), must be built on a wide spectrum of short "quests", where the player will be able to make various choices and face a number of challenges in collaboration with other players, preserving the attraction of gaming through the build-up of the imagination for the next unknown quest, with the completion of every quest. At a learning level, such a narrative "fosters metacognitive skills", "strategic planning skills" and "collaboration skills" (Dickey, 2007, p. 265).

The characters constitute the most important and challenging feature of the design of the social ecosystem of a game (Dickey, 2007). Game designers must offer a series of characters (with a variety of skills and characteristics) from where the gamer will have to make a choice (Blumberg et al., 2013). The attachment of a player to a character and the player's urge to develop it through the game, adds

to the gamer's motivation to play. Moreover, the interest of gamers to their characters, increases their interest in the game content and skills acquisition, which they must develop and master in order to advance their character through the game process (Mayer & Johnson, 2010).

Finally, in the frame of the abovementioned suggestions for game design, the Baker and Mayer's CRESST model of learning (O'Neil et al. 2005; Baker & Mayer, 1999) is suggested as the most appropriate method to assess the gaming experience and gaming process. This model focuses directly and explicitly on the assessment of modes of interaction and skills development in the game, which are directly associated with the health literacy skills and characteristics. Specifically, the CRESST model suggests that a valid mobile educational game assessment must address the issues of "content understanding, collaboration or teamwork, problem solving, communication and self-regulation" (O'Neil et al. 2005, p. 458).

Nevertheless, even if these visible features of an effective online game for health literacy are considered and integrated in it, researchers emphasize that autonomy of gamers and the transparency of the game environment may remain fragmented. Game design has also provided the tools to users to challenge and assess the game environment/world in which they are playing, to be able to suggest adjustments to all features of its ecosystem, discuss them with peers and see them implemented by the game designers, even if the game has gone public (Raphael et al., 2010). Such a process implies that the game mode will not be dependent on timeframes, giving the potential to users to reflect on all aspects of their gaming experience, and to communicate those reflections (Raphael et al., 2010). Moreover, such an approach will have a positive impact on the skills of users where they will enrich their critical thinking skills, negotiation skills and meta-cognition skills (Wilson et al., 2009). As Raphael et al. (2010) stated,

> well-designed games of responsibility and justice may be most likely to increase appreciation of the important opportunities that civic participation can offer youth to form and express their civic views. There is a normative reason for producing more of these games as well: all youth, including those who are already likely to take part in the civic domain, need to consider the ethical dimensions of political practice, not simply how to get and wield power. (title of source?, p. 26)

Such an argument is closely associated with games contextualization and a real-life reflection, where it is expected that gamers will transfer their experiences, skills and perceptions developed in the game to real-life contexts. Therefore, the games should be designed based on what knowledge and experiences are envisioned to be acquired by the gamers and, by extension to be reflected in the public domain.

The aim of this chapter is to outline and propose the basic game design principles that are compatible with the learning objectives of the proposed health literacy framework and, specifically, the attraction of students to be engaged in a collaborative game play to improve their decision- making related skills in the context of health literacy.

2.2.3.1 PlayForward: Elm City Stories Previous Research

As noted in the introduction and will be further analyzed in the following chapters, *PlayForward: Elm City Stories*, the current research was based on a single case study methodology. In this subsection, reference will be made to previous research programs with the use of the *PlayForward: Elm City Stories*, in an effort to demonstrate the differentiation of the current investigation, elements of its novelty and potential research limitation. All these parameters, will also appear in discussions to follow.

The Elms City Stories mobile videogame resembles the life of a student, whose character was built by the gamer. The student faces real-life challenges associated with social, health and wellbeing issues (skipping classes, taking drugs, unprotected sex, hanging out with strangers) which to enter a decision-making process (Fiellin, Hieftje & Edelman, 2013).

Most of the previous research conducted with the use of the Elms City Stories game was based on quantitative research methods, where, through game trials, in-game data were collected by means of integrated "systems of gameplay metrics". No quantitative methods of data collections (observations, interviews) were used in these cases. The qualitative data collected from the game's software included the overall videogame playtime, the duration a player spent in a game chapter, the chapter's successful completion time, and changes in playtime from chapter to chapter (Fiellin et al., 2016; Fiellin, Hieftje, & Duncan, 2014; Montanaro et al., 2015).

Participants in these previous trial implementations of the game had similar ages with the participants of the current research, and were randomly selected from schools, however, the numbers involved in these trials were much larger and for longer duration (2 years on some occasions). Great numbers and longer duration were achieved since data collection was fully supported by the video game. Moreover, all previous game trials were implemented in single-player modes. One primary similarity of the previous research was the implementation of the game in after-school programs within the school environment, with the use of iPad tablets (Fiellin et al., 2016).

One research argues that new methods for data collection, storage and analysis were introduced, while the game may serve as a self-assessment tool for behavior change among players. Also, the use of the game's system to collect metrics secures the outreach of the research to larger

populations for a longer duration. Finally, this research argues that mobile videogames have the capacity to address health literacy challenges (Fiellin et al., 2016).

A second research, where the *PlayForward: Elm City Stories* was tested, argues that there is a gap in investigating the impact of a game on students, as data are only collected from the game system. Data in this case were also collected through the metrics software of the game, through a large number of players. In this context, researchers argue that "objective data" were collected, which demonstrated the direct connection of gamers' success in the game challenges with knowledge development. This outcome was measured based on the playtime of each gamer and the total game levels/chapters completed (Montanaro et al., 2015).

Concluding this section, a pattern can be seen in previous research with the use of the *Elms City Stories* game. Researchers deployed quantitative research methods using the game's metric system, involving large samples with longer duration and concluding with behavior change and knowledge development. Therefore, in these implementations the use of collaborative affordances of the game, the discussion of the importance of gamers' interaction, and their skills development processes have not been seen. This is a novelty of the current research, and, at once, a limitation since the game was developed and pilot tested through a single player mode for a long duration of playtime.

3. Research Method & Implementation Ecosystem

3.1. Research Method Framework

3.1.1. Purpose and research questions

The purpose of this research was to explore the processes of piloting a mobile videogame in a non-formal (after-school) education context for the promotion of health literacy among young adults in

Cyprus. The case study implementation took place in a private school in the suburbs of Nicosia, Cyprus, with the voluntary participation of 15 students of lower secondary education. The implementation was conducted in the after-school hours for 5 weeks (8th of February 2016 - 9th of March 2016) at 2 hours per week. Students were grouped in teams of 3 and played the game collaboratively, aiming to investigate and build their capacities in decision-making, negotiating and critical thinking. Therefore, the unit that the case study research method investigated was the overall ecosystem of implementation with the 5 groups, 3 students each, the internal interactions with the game, between them and among the groups. The theoretical framework of the study is based on the principles of social constructivism. This approach argues that the student negotiates and constructs knowledge and skills as a result of an ongoing integration, negotiation and communication with the ecosystem in which it functions, developing multiple perspectives, truths and understandings. The current case study implementation of the *PlayForward: Elm City Stories* mobile videogame was based on collaboration, interaction and negotiation, therefore, social constructivism was an inherent part of this research method.

This research study is guided by the following research questions:

1. What are the potentials and challenges of using the *PlayForward: Elm City Stories* mobile videogame for promoting health literacy in a non-formal educational context?
2. According to students' perceptions, what are the affordances of the *PlayForward: Elm City Stories* mobile videogame, which can facilitate or hinder collaborative decision-making skills development?

3. How are social gaming trajectories shaped during negotiated play in a social constructivist context, with the use of the *PlayForward: Elm City Stories* mobile videogame in a non-formal educational setting?

3.1.2. Case Study Methodology

Education research has progressed in a more interactive, needs-based and collaborative approach, addressing the majority of the parameters that influence the learning process, such as the target groups, the stakeholders, the environment where it takes place and even the research framework itself (Wang & Hannafin, 2005). Such progresses came as a response to the inherent ongoing challenges of educational research, including the connection of research with the everyday practice of education, the production of sound, valid, adaptable and needs-oriented research outputs (i.e., designs, artifacts and tools, pedagogies, laws), and the transfer of ownership of the research results to the target groups, practitioners, and stakeholders (Van den Akker, Gravemeijer, McKenney & Nieveen, 2006; Vrasidas & Solomou, 2013). Other challenges related to educational research are focused specifically on the widespread absence of research outputs through formative assessment processes. Such a process more accurately reflects the needs of the research's target groups, as it promotes higher levels of interactivity between the research target groups and the research process (Collins, Joseph & Bielaczyc, 2004).

Drawing from the abovementioned educational research shortfalls, and building on the necessity to assess the impact of the Elm's City Sorties mobile videogame on the students' development of their health literacy skills, the "Single Case Study Research Methodology" was selected as the most appropriate research framework for this implementation (Miles, 2015; Dul, & Hak, 2007; Zainal, 2007; Meyer, 2001). A single case approach would allow for a deep exploration

of students' engagement with the game including the collection of data from various sources of information, such as, video-based observations, interviews, as well as an analysis of the game-output (Merriam, 2009). This has been the case in the current research implantation where the students' group interactions have been investigated in detail, collecting data from on the spot observations, interviews, the researcher's diary, and statements of the students after the end of each implementation session.

Case study design is considered one of the "most flexible of all research designs", which provides the opportunity for an in-depth investigation of "of real-life events while investigating empirical events" (Schell, 1992, p.2). The empirical implies that a researcher, through a case study methodology, examines a current event designed to take place in its real-life environment, where the actual event and the context in which it happens interact, and overlap, also providing a wide range of data sources (Vissak, 2005 Eisenhardt & Graebner 2007; Schell, 1992; Eisenhardt, 1989). In this case, the game-implementation took place in a real-life ecosystem, in a technology lab of a school, as part of an after-school program. More, important to the current research is the case study method, which is fully compatible with the unit of investigation, that is, the collaborative interactions and behaviors among-students' groups, as they engage with the game as well as interact with each other in such a real-life environment (Hillebrand, Kok, & Biemans, 2001; Gummesson, 2005).

A number of researchers provided a range of definitions of the case study research methodology (Merriam, 2009; Creswell, 1998; Yin, 1993). Yin (1993) defined case study as an empirical investigation of "a contemporary phenomenon within its real-life context and addresses a situation in which the boundaries between phenomenon and context are not clearly evident" (p. 59).

Bromley (1990) defined case study methodology as a "systematic inquiry into an event or a set of related events which aims to describe and explain the phenomenon of interest" (p. 302).

For the purpose of the current research, a more comprehensive and inclusive definition is adopted, developed by Benbasat, Goldstein, & Mead, (1987). As this definition states:

> a case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations). The boundaries of the phenomena are not clearly evident at the outset of the research and no experimental control or manipulation is used. (Benbasat, Goldstein, & Mead, 1987, p. 370)

In the present research, the phenomenon studied considers how students engage with the game, and how they interact with each other in the process. As described earlier, data were collected through various sources such as: classroom video-based observations, individual interviews, open-ended questionnaires, and the researcher's diary.

Case study has always been part of the qualitative research methodology, and a vast amount of knowledge we now have about our experiential environment is an outcome of case studies (Miles, 2015). This method strives to attach meaning and provide an understanding of the multiple interactions of phenomenon occurring in the multiple environments we engage in (King, Lapsley, Mitchell, & Moyes, 1994). The case in this study is used to define a group of high-school students' engagement with the videogame *PlayForward: Elm City Stories* in the context of an after-school program in Cyprus. In characterizing the nature of students' engagement, the study aimed at investigating the affordances of the mobile video game, the student-groups' interactions, the

outcomes of these interactions, and the overall impact of the specific implementation design on the wider ecosystem of implementation. Additionally, such a process comes about through the various and rich sources of data which secures a direct acquisition of information and validation from different informants (Meyer, 2001). An implementation like the one discussed in this research report secures the visibility of the links, the causes and effects of the variables constituting the context under investigations, which is directly connected to the case study method (Meyer, 2001; Leonard-Barton,1990). So, to distinguish from approaches that are focused exclusively on numerical outcomes and which neglect context analysis, case studies, part of the wider qualitative research framework, support the identification of "casual relations". This lack of differentiation has been one of the gaps identified by previous research on the *PlayForward: Elm City Stories* mobile videogame, where it was exclusively tested through quantitative methods (Fiellin et al., 2016). Having an all-inclusive view on the various interactions, the relations that occur, and how they influence all parts involved, the case study approach builds a detailed, descriptive, informative outline of the event under investigation. These outcomes can also be followed up by other researchers, who identify further result outcomes and correlations (Vissak, 2010; Eisenhardt, & Graebner, 2007). This late affordance of case study methodology is of paramount importance to this research. The intention, among others, was to also provide an account for the use of mobile videogames in non-formal education contexts, which, at the same time, will provide the context for other researchers who go through this report, to identify other results relevant to their own context.

The case study methodology has been used to explore challenging, multidimensional matters, which demand rounded and exhaustive research to investigate social contexts and their fluctuation, through the interaction of participants and tools, such as the field of education (Zainal, 2007;

Gulsecen, & Kubat, 2006). Hence, the case study is considered to be one of the most appropriate research methodologies when investigating information technologies tools, including digital and mobile videogames. This is because the development and successful implementation of such tools are directly linked with the social context in which they occur, and are used (Lubbe, 2003; Darke, Shanks, & Broadbent, 1998;), where the "the boundaries are not clear between the phenomenon and the context" (Baxter, & Jack, 2008, p. 545). As in the current case, the *PlayForward: Elm City Stories* mobile videogame is implemented in a specific format in which social relations, interactions and trajectories are central elements of research. Educational technologies, as an applied scientific field, should be tested in an applied context, where relevant affordances, social shapes development and relation buildups will be tested (Darke, Shanks, & Broadbent, 1998).

The case study method is primarily concerned with questions of "How", "Why" and "What" (Baxter & Jack, 2008; Yin, 2003). In this context, the method directs the overall research to a more contextual focus of real-life situations, not in the wider environment where they may occur, but in the microcosm where a specific event takes place (Noor, 2008). The case study implementation, here, is defined by the microcosm of the students groups' and how this evolves in the wider implementation environment. Moreover, each case study is guided by objectives and research questions, which are the exploratory, descriptive, and explanatory (Yin, 2003). The exploratory case study research, the one adopted for this study, tries mainly to test a hypothesis, descriptive in outlining the effects of a tool implementation, and explanatory in the processes of implementation and investigation. All three approaches may coexist in a case study implementation and analysis, and cannot be viewed "hierarchically" (Zainal, 2007).

For the purpose of this case study, an interpretive framework is followed through, based on the three premises of symbolic interactionism (Blumer,1969; Vrasidas, 2014), which can be addressed through the prism of social constructivism. Three basic premises were posed by Blumer regarding symbolic interactionism. First, human beings act upon the world on the basis of the meanings that the world has for them, in this case, the *PlayForward: Elm City Stories* mobile videogame. Second, the meaning of the world is socially constructed through one's interactions with members of the community, as is the case of the students' groups. And third, the meaning of the world is processed again through interpretation, as students interact, collaborate, negotiate and take decisions. The traditional approach to research tends to ignore the importance of meaning and interpretation of the members of the community, and how these meanings and interpretations shape human behavior. For the purpose of this research, the focus is also on the perspectives of learners playing the game and trying to understand the multiple layers of meaning represented by students' action during negotiated play (Vrasidas, 2001).

3.1.3. Case Study Current Applicability

According to Horner, Swaminathan, Sugai, & Smolkowski (p.280) Single Case Study Methodology encompasses a detailed framework of design, implementation, data collection and analysis, which targets evolving educational environments (Horner, Swaminathan, Sugai, & Smolkowski, 2012). Moreover, a single case study may qualify as an appropriate research framework, if the case to be implemented and tested is "revelatory", meaning that the findings identified in the specific single case are identifiable in other case studies or testing. Such an assumption is extremely relevant to testing information and communication technologies, such as the current case (Schell, 1992; Yin, 1989). Another important feature that supports the applicability of the single case study method for the needs

of the current research is that it focuses on a small "geographical area", a classroom in this case, and on a "very limited number of individuals" (15 students/5 groups) which are in investigated in detail within the limited context where they interact (Zainal, 2007).

Beyond the applicability of the single case study approach to the current research, it would also be interesting to investigate the features of this methodology, which are in full alignment with the theoretical overview presented in previsions sections. Particularly, to examine the alignment of the case study method with mobile videogames implementation in non-formal contexts, through a social constructivism approach and skills development.

The case study methodology is appropriate for framing the design of this study, given that case studies are usually used to investigate behaviors, social interactions, and skills development with a particular emphasis on decision-making. As Schramm argues (1971), "the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions, why they were taken, how they were implemented, and with what result" (Schramm, 1971, p. 6). The interest, here, is in the decision-making processes within the students' groups, how they are built and progressed, what the limitations and challenges are of taking a decision, and which blurry boundaries influenced them (Miles, 2015). Case design, implementation and analysis is fully appropriate for such a challenge (Baxter & Rideout , 2006), as the settings of a non-formal educational environment in a private school provides the opportunity for a decision-making and negotiated play.

A feature of the suggested methodology that also fits within the current research's paradigm was its design to collect data through time, in a relatively long period of implementation, where the researcher has the opportunity to investigate deeply the phenomenon under examination (Vissak, 2010). Additionally, the timely implementation for a qualitative method implementation will provide

the potential to multiply or generate new data resources, where needed (Meyer, 2001). This approach was applied in the current research, given that at the end of every game play session, students made a statement related to their experience and interactions on that specific day, accessing in this way direct feedback from students.

3.1.4. Case Study Implementation Design

The implementation of the case is categorized in 3 groups: (a) duration and location; (b) duration and the phenomenon; (c) wider environment and the meaning (Yin, 2003; Creswell, 1998; Stake, 1995; Miles & Huberman, 1994). For the current research, the binding parameters were duration and the phenomenon since we were primarily interested in the implementation of the mobile videogame in a given timeframe in which it would be compatible with the school's expectations, the game requirements, and the students availability. Prioritizing these parameters, implementation will not "escape" its primary scope, and is focused on the objectives of the research questions (Baxter, & Jack, 2008), as-will be discussed later on.

Moreover, since we are examining a phenomenon which is taking place in its "natural" environment, such as the testing of a mobile educational game, the location of the implementation is also an important parameter of the case implementation. The selection of the case study site should be rather scientific and not "opportunistic" (Benbasat et al., 1987). It should be a location where the researcher could ideally revisit for further testing, and it would secure support and participation based on the needs of the event under examination, accessibility to technology, geographical proximity for regular visits, and organizational flexibility to define the necessary time frame of implementation (Benbasat et al., 1987). In this case, the selection of the specific school for the implementation and testing of the *PlayForward: Elm City Stories* mobile videogame would offer the opportunity to revisit

it at any time, if needed, given the good relations between the research and the school's decision makers.

The compatible design of a case study is of prominent significance both for effective data collection, and overcoming criticism against the scientific capacity of case studies in securing valid outcomes and potential generalization. A case study to counteract such criticisms should demonstrate that:

a. Case Study is the appropriate method to collect the projected data
b. It meets the objectives of the research questions
c. It has a coherence process of implementation
d. It complies with the primary requirements of social scientific research
e. There is a trackable process of data access, collection and archiving
f. Case Study method is aligned with the overall theory of the phenomenon under investigation
g. There is no external influence of data sources

(Zainal, 2007; Tellis, 1997; Schell, 1992)

For the present research, as will be described in the section that follows, case study methodology is: a) fully compatible with the investigation's theoretical framework; b) aligned with the research questions; c) provides the basis for the development of a well-designed and effective action plan for implementation and data collection.

Research design

The game implementation was designed and put forward based on the qualitative case study research design methodology (Merriam, 2009), as it examined the outcomes of students' interactions within the teams and with the game, and how these interactions generated decision- making processes and formulated new skills and knowledge. Qualitative case study is defined as "the in-depth investigation of various interactions, connections and processes between participants, artifacts and the real-life environment where they occur" (Yin, 1993, p. 59). These phenomena are being studied from multiple views, to alter their "complexity and uniqueness" in a given context (Simons, 2009). Such views include those of the 15 students and the researcher. Case study research is essentially (not exclusively), a qualitative research (Sykes, 1990). Gummesson (1988, p.76) provides a universal view in processes and decisions, based on the direct interaction of the researcher with objects of the phenomenon he or she investigates. Moreover, as in the current case study investigation, the primary objective of a case study is to discover and interpret the insights of participants' meaning creation within a real-life context (Meyer, 2001). Therefore, in the case of the *PlayForward: Elm City Stories* implementation and the investigation of students' interaction and decision-making process in an after-school class setting, qualitative case study methodologies were qualified as the most appropriate research method.

The design of the study was based on an in-depth data collection involving multiple sources of information that were rich in context (Merriam, 2009; Creswell, & Clark, 2007). The data collected throughout the game implementation process included videos from the students' teams gameplay, one camera per team, with interaction analysis, and conversation recordings and transcriptions. Additionally, as researcher, I was present during all game implementation sessions, keeping a research diary, updating it at the end of every session, with a wide spectrum of observations and real-

time reflections. More particularly, I was noting phenomena considered to be non-obtainable through other means of observations, such as the various incidents of team-to-team support that were developed through the game play.

Finally, at the end of the game implementation, semi-structured individual interviews with all students were conducted. Interviews are considered to be a central source of data in case study research methods, as they are a gate to participants'/students' perceptions, meaning-making, and decision-making processes (Darke, Shanks, & Broadbent, 1998). Particularly, semi-structured interviews carry advantages which fully fit for the purpose of the current research. Initially, they provided a framework of themes to be covered (Burnard, 1991), which include students' views on the impact of the game on their skills and knowledge, the decision-making process in their team, the connection with real-life, and the game affordances, securing a focus on the research objectives. Moreover, semi-structured interviews are suited to penetrate deeply in the thoughts, perceptions and understandings of different interviewees, adapting the questions and wording, according to the answers provided, the language used, or particular experiences described, to each participant (Harrell & Bradley, 2009). Lastly, as empirical evidence, semi-structured interviews provide more interaction between the researcher and participants, which is in alignment with the overall case study method, and allows the researcher, as part of the case study, to reflect and discuss his or her own experiences and meanings. In this case, it was expected that different students would provide different meanings to their interaction with the game, and their groups, and the intention, as noted above, was to secure a holistic view of the phenomenon. A sample of the questions used in the semi-structured interview protocol (see Annex A for the full protocol) is as follows:

1. What kind of skills do you think you deploy when playing the game? (i.e., decision-making, critical thinking, planning, envisioning, collaborating, communicating)
2. How would you compare this game with other games that you usually play? Can you point to similarities and differences?
3. Did you enjoy playing the game with a partner or would you have preferred to play alone Why?
4. Can you give some instances of decision-making in the game? Give an example.
5. How did you make decisions in your group? Give an example.
6. Do you think the game helped you develop these skills? Explain either way.

With the completion of the observations (video recording and the researcher's diary) and the interviews, all data were professionally transcripted, generating hundreds of pages of raw data, and categorized initially based on their source (videos, notes, audio interviews). A direct involvement in the transcription process, and the re-reading of them for validation purposes, has been a great advantage in the data analysis and coding process. I became familiarized with the data collected, making them more manageable and comprehensive. More importantly, my research advisor also reviewed the transcriptions and raw data, also critical for their coding analysis process validation. The data analysis was based on two stages, the inductive and the deductive (Stake, 2011; Patton, 2002). At the inductive stage, the data collected were classified in coded categories (i.e., game content, design, usability, interactivity, decision-making), using open code techniques, meaning that labels/codes/subcategories were attached to data freely as my advisor and I were reading, without using pre-defined categories (Glaser, 1978). The analysis was done through open coding techniques

by breaking data into distinct ideas and labeling any important information in the process taken from the content. Following that, the name of the labels was decided to form the in vivo codes. Open coding instead of axial coding was considered more profitable in this case study given that this is the first qualitative study done about the use of this game in the context of educational research. In addition, this method has the advantage of providing a "whole image" of the data, as the codes emerge from those instead of assigning pre-existing codes with the risk of missing out other important information drawn out of the data.

Classification of data goes beyond pure terminology links between words, and it refers to connected meaning created in a specific context, where the case study takes place, providing a holistic understanding to the phenomenon under investigation, and gaining, at the same time, new insights to the phenomenon (Downe-Wamboldt, 1992; Weber, 1990). In this context, as I was reading and re-reading the data, I attached labels/codes to them, which eventually resulted in the buildup of meaningful greater categories (Patton, 2002; Coffey, & Atkinson, 1996). These categories were reviewed both by–my advisor and I, ending in higher-order categories, by merging or rejecting previous sub-categories or labels. Below is an example of the data coding in high-end categories.

Table 1: Extract from the data-coding template

Category: Elm's Street Stories facilitated Collaborative Decision-Making Process	
Quotes	**Comments**
I **think for the self** how to find the objective on your own without the help of somebody else because if you play with 2 or more people, you may **have some triple** get into trouble. Not actually making decisions.	Game may not always engage people in decision-making or collaboration, as one of the team's members

If one person gets bored because you can't have 2 people on the screen. (Interview T1-SS)	may get bored and not be active in the game.
The only thing I see if you get started on a level, a second person may help you because if I have a different idea what's going on one person get start. But if you're working alone it's much faster, I think it's more enjoyable alone because you get to see what's going on. (Interview T1-SS)	
I think my parents with my courses on school, what kind of decision I was gonna make. That's the only thing you would call a class I think I go the rest, I forget out my own which decision not on the game I general because of the concept each action. (Interview T1-SS)	Students didn't have many challenges in decision-making in their lives.
Okay, give us an example of a decision-making process in this game! Think of a case where you had to take a decision and you finally took a decision as a group. S2T5: For example, if there was an argument between us and a guy and he insulted us and he wanted us to do something that we didn't want to and we had a lot of choices like insulting him, too or replying with a joke or changing the topic and we tried to decide what seemed right, and then we had to be in the sentence. Sotiris: was everybody was active in the team? In the decision- making process? I mean, did you give your opinion and discuss? S2T5:yes! Sotiris: how important are decision-making skills in your life? S2T5: I think it is very important especially for later in my life a-when new experiences will be available when I'll be an adult, when I move	Decision-making example.

country and go to university and learn more things by myself, I will guide the family and be by myself to make decisions. (Interview T5-CP)	
S2T5: I think because there was a lot of stuff, stages and sections in the game and a lot of details so it needed us all to work together, to work through the game. (Interview T5-CP)	Affordances that support decision-making.
Students start playing the game. They seem excited and dedicated to the game. Debates and disagreements are present. But collaboration is still there. The task here is to categorize and prioritize values that may affect the life of a character in the game (i.e., health, happiness, money, and friends). Losing a value or reducing the points of a value may positively or negatively affect the other values, too. It is a sequence of events. (Observation, T5, 220216)	
R-Do you think **gaming in self** generated skills for decision-making? P-Yeah! It generated skills for decision-making because when you see someone in experiencing decision-making, they don't just press random buttons and do whatever they want. They have to stop to think before they press the button, they actually decide which choice is right even if both choices seem correct they will think one has less disadvantages and which more advantages, and then will act so to generate a lot of skills.	Skills development.

As part of the above process, and based on the higher-order categories and the coded data, I developed assertions, which are statements that give a sense of generalization through data cross-analysis (i.e.,

the above category was qualified as an assertion/claim). At the deductive stage, there was a process of validating or rejecting the assertions. This process required a cross-checking between different categories, to identify overlaps or intersections of supportive or contradictive data, eventually validating, rejecting or merging the assertions. Assertions were only valued through a satisfactory number of data (Vrasidas, 2014) (researchers' notes and transcription quotes in our case), and sketched the overall framework of the research. This process was done both by my advisor and I, in order to secure multiple perspectives which will appear in the data analysis, limit the domination of a one-sided approach, and contribute to the validity of the overall research (Gale, Heath, Cameron, Rashid, & Redwood, 2013). Moreover, the validity of this account depended on the comprehensiveness of the study, and a detailed and holistic description of the procedures followed (Vrasidas & Solomou, 2013).

3.1.4.1. Data Collection

As discussed in the previous sections, the current research followed the single case study methodology approach in order to examine 5 groups of secondary students' engagement with a mobile videogame on health literacy, during after-school hours, as part of a voluntary involvement in the gaming club of their school. The data collected were as follows:

- Video-taped interactions of each groups of students (5 meetings x 1.5 hours)
- Post-Session Students' Statements
- Field research notes
- Researcher's diary (6 diaries, 2 A4 long each)
- post-implementation semi–structured interviews with each of the students (40 minutes long)

In case study research, data sources were dependent on the context of implementation, time and financial resources, therefore, for the current case, the data collection methods selected are based on "usefulness and consequentiality" and constitute a major indicator of whether the general research will have an impact on the theory under investigation and construction (Schoenfeld, 1992). Moreover, there is always the challenge among research to identify more data sources and collect more data, however this could lead the research into a vicious cycle in an enormous data set.

Therefore, the data collection sources and methods in case study research should be considered as "pieces of the 'puzzle' that contribute to the researcher's understanding of the whole phenomenon", and which have already been projected and defined (Baxter, & Jack, 2008). In what follows, a description of these data is offered:

Classroom Observations of Students and videos of students' group game play: as the researcher I was present in the classroom during all 10 sessions where the implementation took place, observing and facilitating the students' game play. At the same time, 5 video-cameras (one for each group of students) was recording the teams' interaction (i.e., conversations) between student' members and their actual game process (i.e., recording the iPad screen). The discussions of students within their groups were transcripted, while notes of the overall context and game play process were taken on each transcription in regular time intervals. Video recording and transcriptions were a supplement, an addition to direct observations. The combination of observations with the use of videos is also a validation process between what people discuss and what they actually practice, while, at the same time, securing the collection of detailed information through a contextual approach, meeting the case study method requirements (Noor, 2008; Meyer, 2001; Pettigrew, 1990).

Field Notes: An important aspect of hypothesis validation and theory development in case study methodology is the frequent overlap of data analysis with data collection (Eisenhardt, 1989). Such an overlap is achieved through the ongoing writing of field notes during classroom observation, something that I did in every session. Field notes, in this sense, are both data collection and data analysis, as thoughts, conclusions and assertions of the researcher are also registered through this process (Van Maanen, 1988). Field notes must be extremely detailed in order to support the report/narrative writing requirements, and must follow a set of questions, such as: "What is new?", "How is this session different or similar to previous ones?", "Is there progress among students' skills development?" These will collect the buildup of the case study implementation (Eisenhardt, 1989).

Post-implementation interviews with students: Semi-structured individual interviews were implemented with all 15 students after the end of the case implementation for the purpose of collecting data, regarding students' perceptions of their learning as well as their views on the game. Questions included: " How would you describe the experience of playing this game?", "How different would your game experience be if you played the game alone? Please explain", and "How did you make decisions in your group? Please give an example." All interviews were recorded and fully transcribed. Interviews are considered to be a critical part of case study methodology given that they provide researchers with the opportunity to interact directly with students (Darke, Shanks, & Broadbent, 1998) and also reflect on their own experiences as part of the overall implementation process.

3.1.4.2. Data Analysis

The data collected were initially categorized in chronological order of the sessions implementation including the video recording transcriptions and the field notes, while the post-interviews transcripts were categorized together, at the end of the overall implementation. Following this practical

categorization of data, I initially read all the data and attached a label to each useful data unit or quote, using an excel sheet with 7 columns. These 7 columns were:

1. Date the data was collected
2. Team from which the data was collected
3. Data Source
4. Label attached to this data (affordances, negotiated play, challenge). For the labels I had 2 columns, 1 for the primary label and the other for the secondary label
5. Number of the research question that this data unit may address
6. Comments/Suggested Assertions

By the completion of the data coding, I use the "Sort" function of the Microsoft Excel Program to group all data sources based on the labels attached to them. Following this, my research advisor re-read all the data and the labels I attached to them, to discuss, reject, enrich and validate the coding and my suggested assertions. I coded the data using open coding techniques. Open coding techniques refer to the process of coding/labeling the data while reviewing/reading them, without having any pre-set categories, and are constantly re-reviewed to identify similarities and overlaps between the categories, narrowing them down to final high-order categories, based on which the initial assertions will be generated (Elo, & Kyngäs, 2008). This was a process that helped draw the framework of the wider research, while giving a deep look into the data and making some preliminary connections prior to the detailed analysis (Eisenhardt, 1989). Drawing from the argumentation above, analysis was based on open coding, as this was the first time the *PlayForward: Elm City Stories* mobile videogame was implemented in this format, and, in the Cyprus context. Therefore, through open coding I wanted

to be flexible in identifying new codes or patterns that did not previously exist (such patterns included the collaborative skills development and the social trajectories created through negotiated play).

It is essential at the overall data analysis to secure the presentation of combined "contextual and data richness" of the case study, which will support the validity and generalizability of the overall research (Baxter, & Jack, 2008; Benbasat, Goldstein, & Mead, 1987). Therefore, data analysis during the overall research, and at every research phase was based on two stages, the inductive and the deductive (Stake, 2011; Patton, 2002). At the inductive stage, data were collected and classified in coded categories (affordances, decision-making skills, social trajectories), using open code techniques (and not pre-defined categories). Reviewing and re-reviewing the data with my research advisor, we developed assertions, which are statements that give a sense of generalization through data cross-analysis. At the deductive stage, and following the above mentioned process, I entered in a process of validating or rejecting the qualified suggested assertions, from the previous stage of data analysis, using the full range of data collected, guided also by the research questions. It is critical to note that assertions were only valued through a satisfactory number of data (Vrasidas, 2014). It was important to remain focused on the research scope and research questions, and to avoid temptations to build new assertions that depart from the overall research objective (Yin, 2003). Moreover, it was important to enrich the analysis contrary to the research scope assertions, in order to provide a different view of the phenomenon being examined, and additionally, to provide a full coverage of the case study implemented and not just conveniently selected parts of it (Baxter, & Jack, 2008). Cases, ~~r~~related to the educational value of negotiated play and the importance of some of the *PlayForward: Elm City Stories* mobile videogame affordances will be discussed later.

In the table below, the research questions and primary data sources connected to these are outlined.

Table 2: Research Questions vs Data Source

Research Question	Data Source
What are the potentials and challenges of using the PlayForward: Elm City Stories mobile videogame for promoting health literacy in a non-formal educational context?	For this research question the primary data sources where: • Detailed analysis of game design and content • Video-taped interactions of each groups of students (5 meetings x 1.5 hours) • Field research notes • Researcher's diary (6 diaries, 2 A4 long each) Data were also used from: • Post-Session Students' Statements • post-implementation semi-structured interviews with each of the students (40 minutes long)
According to students' perceptions, what are the affordances of the PlayForward: Elm City Stories mobile videogame, which can facilitate or hinder collaborative decision- making skills development?	For this research question the primary data sources were: • Post-Session Students' Statements • post-implementation semi-structured interviews with each of the students (40 minutes long) Data were also used from:

	• Detailed analysis of game design and content • Video-taped interactions of each groups of students (5 meetings x 1.5 hours) • Field research notes • Researcher's diary (6 diaries, 2 A4 long each)
How are social gaming trajectories shaped during negotiated play, in a social constructivist context, with the use of the PlayForward: Elm City Stories mobile videogame in a non-formal educational setting?	For this research question the primary data sources were: • Video-taped interactions of each groups of students (5 meetings x 1.5 hours) • Field research notes • Researcher's diary (6 diaries, 2 A4 long each) • Post-Session Students' Statements • post-implementation semi-structured interviews with each of the students (40 minutes long) Data were also used from: • Detailed analysis of game design and content

As noted by Vrasidas and Solomou (2013) "the validity of this account depends, among other things, on the comprehensiveness of the study and description of the procedures followed. This study should be judged for coherence and not for correspondence of the findings with the "objective" world" (Vrasidas & Solomou, 2013, p. 6). Therefore, the effort was to apply a coherent data analysis approach

throughout the research. Furthermore, reporting every phase of the research in detail, with clear sequence and structure, would offer the opportunity to every interested part to make its own analysis and derive its own conclusions on the validity of the assertions selected (Vrasidas & Solomou, 2013), and, to which extent, the outputs of the research are transferable to other contexts and environments.

The abovementioned approach is associated with the discourse analysis methodology, where the examination of context and interaction shapes events, perceptions and characteristics involved in the wider environment under investigation (Gee 2003; Gumperz 1982). Such a process allowed me to comprehend the meaning the participants attach to their class-mates, the class environment, the game environment, the knowledge and skills acquisition, as well as the decision-making process, eventually giving a holistic understanding of the phenomena occurring within the case study implementation (Steinkuehler, 2004).

3.1.4.3. Case Study Reporting

The reporting of the case study constitutes a challenging task in which the research has to bring together a myriad of pieces of events, interactions and developments in a readable format. As already mentioned in the previous chapter, the ultimate scope of the case study report is to replicate the context of its implementation through the discussion and analysis of the data, in such a way that the reader can visualize him or herself as part of the implementation, and can judge the validity and usability of the research outcomes (Baxter, & Jack, 2008; Lubbe, 2003). The case study report, which is practically a storytelling process, can follow two directions, based either on the sequence of events or the analysis of assertions. In the current report, I develop the case study story based on the assertions. As the primary objective of the case study implementation was to address the research

questions, this approach of reporting secures a focus on the relevant findings and avoids the change of direction into interesting but probably irrelevant data (Baxter & Jack, 2008; Yin, 2003).

Once again, this chapter affirms that the reporting process will be detailed, sequential, clear and structured around the research questions. It is extremely important for the researcher to commit to these reporting requirements, as one of the objectives of the present research report is to provide a flexible tool to all stakeholders to examine, assess, adjust and apply to their own contexts, the methods and design principles for using mobile videogames of health literacy for secondary education students. The report is assembled based on five major requirements, as discussed by Collins, Joseph & Bielaczyc in their article, "Design Research: Theoretical and Methodological Issues" (Collins, Joseph & Bielaczyc, 2004).

Objectives and Phases of the Design: The foundation of research reporting Research is to succeed in presenting in a comprehensible manner the interrelations of the objectives that guide the research, the usefulness of the selected research method, and the various phases that will drive its implementation.

Contexts of Implementation: Contextualized approach, as one of the most noticeable characteristics of the case study methodology, must also be central in its reporting. The researcher must provide a detailed description of the contexts and environments, wherein each phase of the research is implemented.

Detail sketching of the research phases: The sequential nature of the research method and the importance of each phase in the evolution of the implementation, theoretical frameworks and expected outcomes require detail sketching in terms of implementation, data collection, data analysis

and outcomes. An objective of the current research is to also provide the opportunity to readers to place themselves in the position of researchers, to analyze the data and derive their own conclusions, maximizing the transferability, adaptability and generalizability of the research. This can be achieved through the detailed sketching of ecosystems, incidents, processes, and practices applied and observed at all phases. Detail account of the research will secure data validation and re-use for future research (Vrasidas, 2014).

Research Results: The results of the research should be connected and discussed with new elements that the research has offered in the research field, and theoretical frameworks in conjunction with the implementation outcomes, which, in the present case, are related to skills development and students' perceptions about the use of mobile videogames in education.

Meta-Design Knowledge: The detail depiction of meta-design knowledge and experience acquired by the researcher through the implementation of the case study is one of the most valuable contributions of this research in the field of mobile videogames for health literacy development and application.

3.1.5. Establishing Trustworthiness

Qualitative Research, and to some extent, case study method, is occasionally criticized about its validity, capacity to generalize results and whether the outcomes are unbiased and objective information (Tellis, 1997; Miles & Huberman, 1994; Sykes 1990; Kirk & Miller 1986). Of course, qualitative researchers rarely argue about a potentially pure objectivity of the implementation and data collection or the unbiased nature of their involvement. On the contrary, a contextual research framework which prioritizes the direct observation and physical presence in the environment where

the phenomena under investigation occurs, is expected to be bias, and the challenge is to reduce that, rather than eliminate it (Stake,1994). The premise abovementioned, which is considered a shortfall of a case study methodology, can be turned into an advantage. My presence in the classrom, the direct interaction with the participants, and the detailed and rich discourse analysis, provide the reader with an authentic environment, and a coherent story of complex events, which it can be attached to, investigated and draw its own conclusions (Zainal, 2007; Sykes 1990). Case study researchers can overcome the criticism and the challenges of validity, generalizability and objectivity, by designing and presenting a comprehensive research action plan based on recognized scientific procedures, securing access to multiple resources, and providing detailed descriptions of the phenomena (Lubbe, 2003), as this has been the effort of the implementation of *PlayForward: Elm City Stories*.

As mentioned earlier, it is being argued that research validity and objectivity is influenced by the long periods of the researchers' presence in the context being investigated. To counteract this argument, I have primarily acknowledged the influence that my presence may cause the environment that I was examining, and tried to minimize my visibility and influence on the event as it is occurring (Meyer, 2001; Gummesson, 1988). In my case, it was a relatively easy task, as I was detached from the students' teams which played and interacted with the game. The documentation of all relevant methodological, implementation and research processes is provided in detail, as well as the data collected, for other researchers to analyze and validate the outcomes. Also, selected data are provided within the research report in their primary format, such as quotes, photos, diagrams and drawings (Miles & Huberman, 1994). For this study, all the data are accessible, upon request, to any interested part. Moreover, counter assertions or conclusions, where appropriate, are presented and discussed, as already mentioned in the previous chapter. Furthermore, validity of the case study was secured

through the long period of its implementation and the ongoing observation of the event at its various phases. Validity was also secured by using multiple data resources, providing a holistic approach into the investigation, where, at the same time, participating students provided regular reflections on their experiences, (King et al., 1994; Leonard-Barto, 1990; Hakim,1987). In this research context, triangulation is secured, bias is minimized, data and information are maximized, and conclusions are well-constructed (Schell, 1992).

Others have argued that case studies are short of accuracy, precision and objectivity, and these are major reasons to be under regular critique (Cassell & Symon 1994). To face these challenges, case studies implementation must be aligned to the research questions, the well-designed data collection process from multiple resources, and provide a detailed analysis of the contextual implementation and data analysis (Baxter, & Jack, 2008). It is also important to have in mind that the case study story is a presentation of a "virtual reality" to readers, who will be engaged, interacting, exploring, discovering and making their own conclusions. This constitutes an opportunity highly attractive for all interested parts of the case study implementation in any scientific field (Flyvbjerg, 2006).

For the purpose of this study, data were collected from multiple sources and were fully used and deployed in constructing the overall research framework, as well as generating and defending assertions derived from data coding. The sources from where data were collected included a videotaping of the gaming process and interaction among the students' teams, which included a mini-interview at the end of each session (each team had to make a statement on its collaborative gaming experience and whether they learnt something new on that specific day). Also, I was present in every game play session and was taking detailed field notes, which proved to be extremely helpful to reflect, validate and cross-check my perceptions and understandings generated during the implementation

with the actual video-taping of the case study (Eisenhardt, 1989). Finally, semi-structured interviews were conducted with all the 15 students that participated in the case study implementation. Additionally, in order to establish internal validity of the data collected through the interviews, the interview included protocol questions that asked for the same thing in a different way, checked the respondent consistency, and secured a detailed reply (Hakim, 1987). A few sample questions follow:

1. Did you enjoy playing the game with a partner or would you have preferred you played alone? Why?
2. How different would your game experience be if you would play alone? Please explain.

Another important aspect of validity establishment was the coding of the data, independently, by two researchers, my advisor and I, which secured an insertion of multiple perspectives in the data analysis, the cross-checking of the coding process and the limited domination of one-sided approaches (Denzin,1978). The collected data were reviewed and re-read multiple times to end up in the higher order categories, which were again cross-checked between my advisor and I (Russell, Gregor , Ploeg, DiCenso, & Guyatt, 2005). Finally, validity is highly connected with comprehensiveness and detailed sketching of the research framework and implementation process, which offers the opportunity to readers to place themselves in the case study environment and conduct their own analysis (Vrasidas & Solomou, 2013). In the following chapters, I have attempted to describe clearly, and with scientific detail, the story of the *PlayForward: Elm City Stories* case study implementation.

Generalization

A popular criticism of case study methodology is that it is dangerous and overchallenging to generalize its outcomes, due to its deep investigation of microcosms (Tellis, 1997). The generalization

of a case study research is attached to its selection by the researcher. If it was "purposefully" selected, as in this case, it implies that it could provide the information and the context to generalize its outcomes, to some extent (Johansson, 2003). Case study researchers, like myself, are not necessarily interested in "big samples" and generalizations. Instead, we are interested in the deepness of a particular phenomenon (i.e., how students interact in groups as they engage with the specific mobile videogame), which is investigated based on pre-set parameters and objectives (Yin 1994). "Case studies include both the particular and the universal without being mutually exclusive, and move between the particular and universal in graded steps" (Miles, 2001, p. 314). Therefore, the purpose of the single case study research method and qualitative research is to deeply investigate the interactions of the target groups in the ecosystem where they occur. In this context, generalization is not a priority (Mason, 2002; Shenton, 2004). The priority of this research was to analyze and understand the case at hand. In this case study, my primary intention was to test the *PlayForward: Elm City Stories* game in an afterschool program and to see how it facilitates the decision-making process among students' teams. Nevertheless, even if the findings of this study cannot be generalized in the conventional paradigm, they can, however, be transferred to similar out-of-school contexts, and with similar populations (specific students' characteristics). The detailed description of the implementation ecosystem, the research method and data analysis, and the current research provided can help other practitioners and researchers to extract and utilize selected practices and suggestions for videogames integration in education.

Role of the researcher

Following the qualitative case study approach selected for this study, as the researcher I was responsible primarily for the collection of data, analysis, and interpretations. My epistemological

beliefs are grounded within sociocultural theories of learning and the assumption that learning is a process of appropriating "tools for thinking," which are made available by social agents who initially act as interpreters and guides in the individual's cultural apprenticeship (Rogoff, 1990). Hence, in this study I was interested in examining the social processes, as evidenced in students' interactions and discourse, through which students made meaning out of their engagement with the mobile videogame and constructed knowledge. As a researcher, I have ten years of experience with various projects in the area of games and health literacy, and am, therefore, familiar with gaming culture, which attests to the trustworthiness of the study. Nonetheless, I have an inevitable personal bias about the success of this intervention. It is then possible that this bias impacted my interpretations of the data in that direction?, which I tried to minimize with the use of checks by external researchers and advisors so as to moderate the bias.

3.2. Implementation Ecosystem

3.2.1. The Game

PlayForward serves as the foundation for the play2PREVENT Lab (http://www.play2prevent.org/) and is funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development in the United States. The project's goal is to develop and evaluate an interactive mobile videogame designed to provide young teens with the opportunity to acquire and practice skills around smoking and drinking prevention, and to learn of the risk-reduction of health issues (e.g., HIV prevention). This mobile videogame incorporates evidence-based concepts from prominent behavior change theories, including self-efficacy, social norms, message framing, and delay discounting. PlayForward is an interactive world in which the player, using an Avatar (virtual character) they have created, "travels" through life, facing challenges and making decisions that bring different risks and

benefits. Players have the ability to see how their choices affect their lives, and subsequently, are able to move back in time to see how different actions might have led to different outcomes. By negotiating challenges in a highly repetitive and meaningful way, players learn skills that translate to real-life, equipping them to avoid situations that increase the risk in smoking and alcohol use, and other possibly negative health outcomes.

According to members of the play2PREVENT Lab, in their article "Using Videogame Apps to Assess Gains in Adolescents' Substance Use Knowledge: New Opportunities for valuating Intervention Exposure and Content Mastery":

> The main narrative of the game is comprised of 'challenge stack' levels in which players travel through a virtual life from grade 7 to 12 and engage in role-playing scenarios where they must make decisions around risky behaviors (e.g., unprotected sex, alcohol use) and experience the positive and negative consequences of those behaviors. The participants acquire risk-related knowledge, navigate peer relationships, and negotiate against peer pressure. Players encounter realistic stories experienced by middle school and high school students, such as sneaking into a significant other's house, unplanned pregnancy, vandalism, and drunk driving. Players must also earn points in mini-games designed to build knowledge or behavioral skills needed to avoid risk, such as refusal, negotiation, or peer-assessment skills. Through these mini-games, players acquire the 'senses' and 'powers' needed to resolve the stories. (Montanaro et al., 2015)

It is apparent from the game description that the game is based on developing decision-making skills to navigate through challenges. This approach is also evident in the PlayForward Implementation

Guide (Not for Distribution) where players are encouraged to consider and reflect on their game-play based on questions, such as the blow:

- Pause and Think: Why is it important to consider the possible positive and negative outcomes before making a decision? What are the benefits of doing this?
- Can you think of a decision you made in your life of which you wish you had considered the consequences first?
- What might make your decision-making more difficult?
- Who might be affected by your decision?

Below are some screenshots from the game where the decision-making skills need to be deployed.

Figure 1: ME POWER Chapter – MY HEALTH Mini Game

Figure 2: Know Sense Chapter – Mad Meds Mini Game

Figure 3: Refusal Power Chapter – Fight or Flight Chapter

In the above model, we visualize the potential sequence of behavior change that may occur to players, as they play each different chapter of the game: how this sequence may lead to the overall goal of the game which, among others is to reduce HIV infections among youth.

3.2.2. The School and Initiation Process

From the very beginning of the case study research design, my advisor and I planned the case study implementation to take place in a private school in Cyprus, as it had two major advantages over a public school. Firstly, the process to get permission to implement a game related to sex education and addictions would be less time-consuming and bureaucratic for a private school. Secondly, a private school would secure the presence of students in an afterschool setting, as they regularly run thematic clubs in the afternoons. We initially approached a private secondary school near the Nicosia center, which declined the invitation on the premises that the implementation would be time-consuming for its staff, and didn't see any added value to this initiative. The second school we approached, which is located in the south-west suburbs of Nicosia, gladly accepted our invitation to implement the *PlayForward: Elm City* stories case study among selected lower secondary education students. This school saw the game implementation as an opportunity to advance its learning and pedagogical models to its students, and build its capacity to provide similar initiatives to its students.

As we were informed during our first meeting with the head of the school's technology department, who would be the overall coordinator of the afterschool game implementation, the school had the vision to advance the digital and technological skills of its students, and convey to the public the profile of an innovative school. In this context, the school recently became the first Microsoft Office testing center in Nicosia; it initiated a collaboration with LEGO, which equips its labs with robotic tools and artifacts, and is involved in an ongoing reform of their curriculum to integrate more

technology in its classes. Apparently, this vision has substantially influenced the decision of the school to implement the case study research of a mobile videogame developed by a department of Yale University. My advisor and I had in total two meetings with the schools' technology department team, composed of the Department Head and two Technology and Robotics teachers. During the first meeting, we presented our research plan to the school's team, the purpose of the study, and how it would benefit the school. Regarding the last point, we noted that implementing an educational game in their afterschool program, would also be a case study research for them and could test how to utilize and integrate educational games in their formal curricula. During our second meeting, we received official confirmation for the implementation and discussed the case study implementation action plan, which included the recruitment process of participants, the time schedule of the implementation sessions, the administration of the lab, the overall duration, and what the expected support to be provided by the school's team.

On the occasion of the abovementioned agreements between my advisor, the school and myself, I submitted my research proposal to the Cyprus Bioethics Committee, to secure the permission of the Committee prior to the students' invitation, as the game dealt with health issues. The Committee provided a positive reply regarding the research implementation, noting that the research didn't fall under bioethics regulations or violations. The Committee suggested only an addition in the Consent Form for the Parents' two fields of signatures, corresponding to the potential participants' parents or guardians (see Annex B).

3.2.3. Participants

The schools' technology department team suggested that they would take the responsibility of the recruitment process of potential participants at the game implementation. As it was the beginning of

the spring semester, the technology department viewed this game implementation as a good opportunity to create a Games Club, which it could run unofficially, during afterschool hours. My case study implementation would be its first activity, and then it could evolve as an official school club, depending on its potential members. I have to say, at this point, that this progress can be considered as having a positive impact on the game case study implementation in this school. So, the school invited participants both for the case study implementation and the games' club from its secondary education classes. It disseminated invitations, posters and leaflets to all target group students of the school, based on a convenience sampling approach. The school team noted in the invitation that for the initial membership to the club, and participation to the case study implementation, there were only 15 positons available, so participation was based on a first come, first served approach. All 15 participants interested were provided with a consent form to be signed by their parents or legal guardian, informing them about the content of the game, the filming of their children, the approval by the bioethics committee, and the full protection of the participants' personal data (Annex C).

In total, 15 students were recruited for the case study implementation, 3 female and 12 male, all aged between 15-16. Table 1 shows the overview of the demographics of the participants, as provided by them in our 1st session.

Table 3: Case Study Participants Demographics

No	**Gender**	**Age**	**Play Digital Games**
1.	Male	15	Almost Everyday
2.	Male	15	Few Times

3.	Female	15	Almost Everyday
4.	Female	16	Almost Everyday
5.	Male	15	Almost Everyday
6.	Male	15	Almost Everyday
7.	Male	15	Few Times
8.	Male	15	Almost Everyday
9.	Male	15	Almost Everyday
10.	Male	16	Almost Everyday
11.	Male	15	Almost Everyday
12.	Male	15	Few Times
13.	Female	15	Almost Everyday
14.	Male	16	Almost Everyday
15.	Male	15	Almost Everyday

As demonstrated in the table above, all participants were familiar with mobile videogames, having, also, a basic knowledge of mobile devices.

3.2.4. Lab and Equipment

The case study implementation took place in an advanced, colorful, technology lab (Image 1), which is used mainly for robotics courses, based on lesson plans developed by LEGO. The lab had 5 stations/tables with a special stand for laptops and tablets, and seats for at least 3 students per station.

Photo 1: Implementation Computer Lab

During our case study implementation, a camera was placed at each station in a position where it could videotape and record the game play process, the discussions, and the interactions within the students' teams. The cameras were usually placed behind students, as in Image 1.

In collaboration with my advisor and members of the advisory committee, we secured 5 game licenses from the Play2Prevent Lap, which is part of the Yale Center for Health & Learning Games. The game application was, at the time, only compatible with the iOS platform of Apple, therefore, I secured 5 iPad Air (Capacity: 16GB) at the Centre of Research and Development in Educational Technology (CARDET), which provided them for the implementation of the case study.

3.2.5. Implementation Process

The case study implementation was 5 weeks long, with 2 sessions per week for a duration of 60 minutes per session. In total, there were 10 sessions and 10 hours of game play for students. Two

additional weeks were added to the implementation, during which the post-implementation interviews with students took place.

The implementation design foresaw my presence in the lab during the play sessions, along with an assistant who controlled the cameras. This gave me the opportunity to observe and note the various interactions between the students and the game. All students' groups game play was video-recorded, and all observations were enriched with my field notes.

In the image below, one can see the LEGO lab where the intervention took place, with the groups of students playing the game and-cameras recording their interaction.

Photo 2: The lab during an implementation session

During the 1st session students were informed about the game implementation and case study in which they would participate, its purpose, the connection of the game with Yale University, the importance

of the game's testing with their support, and the potential of establishing a gamer's club for their school, as an outcome of this initiative. They also had the opportunity to form their own groups of 3 persons. Later, throughout the session, they were invited to complete a simple questionnaire on demographics, including some questions about their familiarity with game play and mobile devices. As was evident from the questionnaire analysis, all participants were very often playing mobile videogames and were expert users of mobile devices (mobile phones or tablets). Before the end of the 1st session, I distributed the 5 iPads to the groups, and opened them to access the game, so they had an initial view of its interphase and graphics. The game narrative and mini-game's format, as described below, are from the *PlayForward: Elm City Stories* Game Manual. The teams built their avatar, picking a gender and name, and entering at the 1st location, where they needed to find key points to change the decision of Mr. Walker (the professor) who caught our students and Tatiana, a pregnant teenager who is a game character,) copying their homework. Key points are spread out in the class room (i.e., the US Flag), and when the gamer touch on them a pop-up comes up providing information on the character of the professor or the situation of Tatiana.

Figure 4: Elm City Stories Game 1st Location

These pop-ups lead to mini-games, which would ideally guide our students to take the decision to either confess their cheating and why it happened, or lie to their professor.

Depending on which key point each team touches first, it becomes engaged in a different mini-game/challenge at the 1st Level of the game. The Level 1 challenges, fall under four of the wider chapters of the game, which are the Me Power, the People Sense, the Know Sense and the Priority Sense.

All teams from the 2nd to the 3rd session were fully engaged in the Level 1 challenges as described below. The Level 1, Me Power mini-game refers to the "Who I Am", where each team has to choose pictures and phrases to describe itself/avatar.

The Level 1, People Sense mini-game refers to the "New School, New Friends", and the players must build up the friends of a game character, and based on those friends, accept or decline invitations to participate in parties, smoke or drink alcohol. The players must gain 3 starts in this mini-game by archiving high friendship points, which translates into going out with friends without getting in any trouble or unhealthy activities.

The Level 1, Know Sense mini-game, refers to the "Kayla is Pregnant" story. The story is that there is a rumor in the school that a girl is pregnant. Through various questions referring to sex protection where the players must answer, they will be guided to find out if the rumor is true.

The Level 1, Priority Sense refers to the Opportunities story, where the players must guide a game character in taking the correct decisions in terms of drug trafficking, or participating in wild parties in order to raise his or her school points up to 80, and support him or her in entering a college.

The teams from the 4th up to the 5th session moved to the 2nd Level of the game and had to deal with mini-games and challenges in People Sense, Refusal Power, and Me Power. At this level, the scenario starts from a gathering at a pool with friends. The game's character leaves the pool with some other kids and ends up in trouble with the police for vandalizing a house. The player must identify the Key Points at the different locations where the scenario takes place (i.e., the pool, the vandalized house) and face the challenges of the 2nd Level mini-games.

In People Sense, the mini-game is the Up to No Good story and the challenge is to help a classmate make friends, and advise him or her with which friends to hang out, and how to acceptand decline invitations. As in all mini-games a specific number of stars has to be gained in order to move to the next level. In this mini-game, gaining 3 stars is associated with friendship points gained, based on decision-making to do with making new friends and hanging out with them.

On Level 2 is the 1st appearance of the Refusal Power chapter. The game character has to refuse mini-game to a friend, to skip class without breaking the friendship. The game character must block the arguments for skipping class and eventually say, No, without having any friction with its friend.

The Me Power chapter on this level focuses on HOBBIES, where the game character has to choose pictures and phrases of hobbies that it is doing now, or would like to do in the future.

Figure 5: Level 2 – ME POWER – HOBBIES

From session 5 and onwards, teams start having different speeds in completing levels, where Team 4 (the team of the girls) reached up to Level 11 (there are 12 levels of the game in total) by the end of the final game session 10, and the other teams reached up to Levels 9 and 10. Below is an outline of the scenarios and the mini-games from Level 3 to 11.

In Level 3, the game character i attends a party where it must avoid many harmful challenges, such as getting drunk, taking drugs and having unprotected sex. It must maneuver through these challenges without his/her friends making fun of him/her.

At the Priority Sense of Level 3, which refers to the mini-game, Consider the Risks, the players must keep the game character away from unhealthy actions that its friends invited him/her.

The Know Sense of Level 3 refers to the mini-game, The Drinking Game, where students must guide a game character through knowledge questions to identify risky situations associated with drinking alcohol.

The Refusal Power chapter has 2 mini-games at this level. The 1st mini-game refers to the Going Upstairs story, where student teams must help a game character refuse an invitation to go "upstairs" with a person that was flirting with it, without hurting its feelings. The 2nd mini-game refers to Drink & Drive, where students need to support a game character to refuse getting in a car with a drunk friend after a party.

The final mini-game of Level 3 is under My Power chapter and is called Stuff, where the players have to choose pictures and phrases of the things they want to have in the future.

At Level 4, the scenario states that the students' game character is visiting a friend, who is living with her grandmother, and this friend pushes the students' character to take some pills for fun, which it does and this causes health effects. Then the friend also suggests taking these pills to school. The locations of Level 4 are the friend's living room and the school.

In the mini-game of the Refusal Power of Level 4, students must support a game character to build up a strategy to say, No, to friends that invite her to get drunk. The other mini- game of Level 4 is under the, Me Power, which refers to the CAREER, wherein students' teams must indicate pictures and phrases that describe the job they would like to do in the future.

At Level 5, our game character is faced with another challenge, where it needs to take a decision, as friends invite it to a secret party; it can either reject it and break the friendship or accept it and maximize its reputation at the school, at the risk of getting caught. The mini-games at this level

are under the Priority Sense chapter, where the character has to balance time between friends and family, and, in the Know Sense chapter, the character has to support a friend on issues of drugs and alcohol.

Figure 6: Level 5 – Priority Sense Mini Game

At Level 6, the students' teams have to deal with their game friend Michelle who wants to go to a party at the house of the teams' character. The mini-games, at this level, are under the People Sense, dealing with issues of making friends, the Priority Sense where the game character needs to balance between sports and studding; the Know Sense which focuses on knowledge with regards to drugs; the Me Power where the players are invited to express their preference in an ideal house, family members and health issues; and, the final mini-game is under the Refusal Power, where the game character has to refuse unprotected sex.

At Level 7 of the game, the game character reaches tenth grade and faces the challenge to go serious with its partner. The locations where the scenario takes place is in the game character's bedroom and the school. There are five mini-games in this level under the Priority Sense, Know Sense

and Refusal Power, which deal with challenges of choosing friends, having knowledge on unprotected sex and saying no to drugs.

Figure 7: Level 7 – Know Sense

Our students' teams at Level 8 have to deal with issues of dangerous driving and unprotected sex. The challenges take place initially at a parking lot, and later on, in the game character's bedroom. The mini-games of this Level refer to the People Sense, where the students' game character has to help another game character make friends; the Priority Senses where the game character has to balance between house obligations and going out; the Know Sense where the game character is invited to demonstrate its knowledge on the effects of alcohol; the Refusal Power where students must avoid a fight; and finally, the Me Priorities where the teams have to choose their personal priorities (i.e., travelling, working, studying).

At Level 9, the students have to deal with a game character that contracted HIV and has to decide how to tell its friends and the school nurse. The mini-games attached to this level are under

the chapters, Priority Sense, People Sense and Know Sense, and have to do with decision-making on saving money, making friends with a positive influence, and information about drugs and HIV.

Figure 8: Level 9 – Know Sense

Level 10 takes our students to the prom where their date challenges them to leave the prom and go somewhere privately, risking getting in trouble. Mini-games here are related to Refusal Power on using drugs and Me Power on choosing their dreams.

Level 11 is the highest level a team of students managed to reached by the 10th implementation session. The game character is at 12th grade and is invited by its parents to discuss issues of sex, and how it would react to relevant challenges. At this level, there are 2 mini games under the Priority Senses chapter, which address issues of balancing between challenging habits, hobbies and friends; 1 mini-game under the People Sense, where the game character needs to choose friends that would not get it in trouble; and 2 mini-games under the Know Senses, referring to HIV and safe sex.

Figure 9: Level 11 – Know Sense

During the completion of the 10th session, in collaboration with the International Research Centre CARDET, I awarded the students with T-Shirts, USBs and a certificate of participation and of commitment to the case study implementation. This was appreciated by the students, and since it was not communicated to them from the beginning, they saw it as a positive surprise. For efficiency purposes and to avoid getting students overcommitted, we planned and conducted the post-implementation interviews with students at the 9th and 10th session, and at two additional sessions, after the official completion of the implementation. The interviews were individual and semi-structured, and each interview had a duration of 40-60 minutes.

In the table below, the overall implementation process including pre and post sessions organized with the school staff and students are outlined.

Table 4: PlayForward: Elm City Stories Case Implementation Chronogram

Session	Activity/Game Level (s)	Data Sources
Planning Session 1	Meeting with the school's staff in Technology Department to present the game and our vision	Game Overview Presentation
Planning Session 2	Meeting with the school's staff in Technology Department to finalize the action plan of the implementation	Implementation Action Plan, Consent Forms Templates
Implementation Session 1	Introduction to the students, collection of demographics, familiarizing students with the game	Demographics Table, Camera Recordings, Field Notes
Implementation Session 2	Students' teams play Level 1 of the game	Camera Recordings, Field Notes
Implementation Session 3	Students' teams play Level 1 of the game	Camera Recordings, Field Notes
Implementation Session 4	Students' teams play Level 2 and 3 of the game	Camera Recordings, Field Notes
Implementation Session 5	Students' teams play Level 3 and 4 of the game	Camera Recordings, Field Notes
Implementation Session 6	Students' teams play Level 5,6,7 of the game	Camera Recordings, Field Notes

Implementation Session 7	Students' teams play Level 6,7,8 of the game	Camera Recordings, Field Notes
Implementation Session 8	Students' teams play Level 7,8,9 of the game	Camera Recordings, Field Notes
Implementation Session 9	Students' teams play Level 8,9,10 of the game	Camera Recordings, Field Notes, Interviews Audio Recordings
Implementation Session 10	Students reach Levels 9,10 and 11, Parallel individual interviews, awarding of students' participation and commitment	Camera Recordings, Field Notes, Interviews Audio Recordings
Post-Implementation Session 1	Conducting final interview with the remaining students	Interviews Audio Recordings
Post-Implementation Session 2	Conducting final interview with the remaining students	Interviews Audio Recordings

4. Assertions Justification and Validation

4.1. Introduction

In the current chapter, the set of assertions, as they emerged through the data analysis, which took place at the inductive stage of data analysis, and the classification of all data collected in coded categories will be discussed. In order to validate or reject assertions, selected quotes from the data coding will be presented and discussed. Moreover, the assertions are examined for an overlapping or

intersection between them and their respective supporting data. Assertions are only validated through a satisfactory number of data collected and coded.

So, at the inductive stage of data analysis five major assertions were developed, accompanied by sub-assertions, as outlined below:

1. Affordances of the game, such as the variety of play modes, the technical aspects of the game (sound, usability, rating system, and visuals), the support for collaborative play, the game narrative connections to real-life contexts, and the potential for skills development, guided the learning game-play experience of the students.
2. Students believed that their participation in the *PlayForward: Elm City Stories* mobile videogame implementation case study, facilitated their engagement in decision-making, and developed their communication and critical thinking skills in a conscious and comprehensive manner, however, in reality their participation in decision-making didn't illustrate negotiations of ideas.
3. Negotiated and collaborative play in teams shaped social gaming trajectories, such as students' inter-personal relations, self-reflections on students' own life experiences, and discussions beyond the game themes.
4. Integration of the game for health literacy education, generated series of opportunities and challenges, such as the attractiveness of collaborative play and learning, the promotion of a customized needs-oriented learning, the bridging of formal and non-formal education modes, and the appearance of a learning curve, which students need to go through to become familiar with the game.

5. Students developed positive perceptions about the use of games in education, since they believed that collaborative game play supported the development of a variety of skills, empowered them to learn the content, and offered alternative educational modes of interaction and learning.

The above assertions are directly linked with the research questions, as demonstrated in the table below.

Table 5: Research Questions vs Assertions

Research Question	Connected Assertions
What are the potentials and challenges of using the PlayForward: Elm City Stories mobile videogame for promoting health literacy in a non-formal educational context?	3. Integration of the game for health literacy education, generated series of opportunities and challenges, such as the attractiveness of collaborative play and learning, the promotion of a customized needs-oriented learning, the bridging of formal and non-formal education modes, and the appearance of a learning curve, which students need to go through to become familiar with the game. 4. Students developed positive perceptions about the use of games in education because they believed that collaborative game play supported the development of a variety of skills, empowered them to learn the

	content, and offered alternative educational modes of interaction and learning.
According to students' perceptions, what are the affordances of the ***PlayForward: Elm City Stories*** mobile videogame, which can facilitate or hinder collaborative decision-making skills development?	1. The affordances of the game, such as the variety of play modes, the technical aspects of the game (sound, usability, rating system, and visuals), the support for collaborative play, the game narrative connections to real-life contexts, and the potential for skills development, guided the learning game-play experience of the students. 2. Students believed that their participation in the *PlayForward: Elm City Stories* mobile videogame implementation case study, facilitated their engagement in decision-making, and developed their communication and critical thinking skills in a conscious and comprehensive manner; however, in reality, their participation in decision-making didn't illustrate negotiations of ideas
How are social gaming trajectories shaped during negotiated play in a social constructivist context, with the use of the ***PlayForward: Elm City***	3. Negotiated and collaborative play in teams shaped social gaming trajectories, such as students inter-personal relations, self-reflections on students' own life experiences, and discussions beyond game themes.

Stories mobile videogame in a non-formal educational setting?	5. Students developed positive perceptions about the use of games in education, as they thought that collaborative game play supported the development of a variety of skills, empowered them to learn the content, and offered alternative educational modes of interaction and learning.

4.2. Assertion 1: Game Affordances

The affordances of the *PlayForward: Elm City Stories* mobile videogame, and its impact on the play and learning experiences of students, have been a pivotal element of this research. I was interested in examining which features of an educational game would make it attractive to lower secondary education students, and how these would promote their effective engagement. Moreover, as a potentially valuable outcome of this research, I considered studying the impact of this type of game on students' health literacy related skills. In light of these intentions, and through the analysis of the data, I formulated the 1st assertion related to the research outcomes, which states; The affordances of the game, such as the variety of play modes, the technical aspects of the game (sound, usability, rating system, and visuals), the support for collaborative play, the game story line connections to real-life contexts, and the potential for skills development, guided the learning game-play experience of the students. This assertion is discussed in five different sub-assertions related directly and indirectly to the overall game affordances and characteristics.

Students perceived the game's narrative as relevant to their everyday lives, an element that added to their knowledge and skills development

The narrative of the game is probably as important as the scenario of a movie. The game's narrative is attached to the gamer's engagement to the play process, the triggering of imagination, the familiarity of the game environment, and contextualization. These affordances of a game's narrative are also relevant to an educational process, which attracts students' conscious participation, knowledge and skills buildup and transferability to real-life contexts, in line with primary features of a social constructivist approach, where meaning is negotiated and contextualized. The game's narrative and mini-game themes foster students' engagement and enthusiasm throughout the game, depending on how relevant that section of the story or theme is with students' personal experiences.

> Students are becoming enthusiastic and dedicated again. The mission is about sexual pressure, and the challenge is to take a decision on how the reaction of someone experiencing that kind of behavior should be. They laugh, play and discuss, bringing themselves to the position of the game character, arguing what their decision would be in similar cases. (ObsNotes, T4, 220216)

The game narrative and its real-life relevance seems to be important for an educational game, as it contextualizes knowledge and empowers conscious participation and collaboration. Part of a games' narrative is also its characters. Students are attracted to the characters, something that contributes to their further engagement in the game.

> P1: Why are you reading it again?
>
> P3: I want to learn the whole story behind her! I like her a lot!
>
> P1: Hahaha! He is going home to write stories for her!

P2: Yes, the story of his life! (Obs., T3, 290216)

Such an interest in the narrative and characters could be highly educational, providing hidden knowledge on health literacy, as students learn about the characters' background and actions. Through the process of analyzing and negotiating the development of a character, students are trying, through a social constructivist approach, to understand and give–meaning to various attitudes of these characters,

Although, some students did not really find the game's narrative attractive or fun. Being bias about the commercial games they were playing, the linear story of a kid's school and neighborhood experiences seemed a bit boring for some players.

> Yes, maybe because this game's story was about a boy who progressed through the years, maybe if it was like an adventure game, I would find it more interesting, and the adventure and the person may be more fun. (INT., T5, CP, 210316)

It became obvious that a game's narrative is a dynamic element of the overall game design, which influences attractiveness and engagement. For an educational game, the challenge is to tell a story that will also be educational and relevant to students' needs, expectations and feelings.

Apparently, as discussed till now, the greatest challenge of an educational game is to build the knowledge and skills of students, and, at the same time, to help them comprehend how they could contextualize them and transfer them to their real life. In the game under investigation, it appears that its narrative bears this affordance and capacity, as students in many occasions linked their decisions within the game with real-life experiences.

> S: That was very helpful, especially the parts, where she was a bit mean on some occasions. We won quicker because we talked like that. But personally, I don't think it's correct to reduce your attitude and character to the level of a person that talks in such a bad way, swears! I would avoid this. For example, a person may use irony and be aggressive. Are you going to do the same? There were many cases like this in the game!
>
> R: OK, this statement is very interesting!
>
> S: I also like the part on the pressure because you notice how people press you, and you can make a decision on how to be excused, funny or mean!
>
> R: Which are things you also face in your life, right?
>
> S: Yes, of course! Many times I think, what should I say now? Shall I adopt the same attitude? Shall I swear, too? (Int., T4, NM, 210316)

On many occasions, the game story overlapped with students' real-life stories, offering authentic and transferable experiences to students, fulfilling the relevant element of social constructivist pedagogies. This affordance of the game maximized its impact on skills and knowledge acquisition, and real-life connections. Particularly, for any health literacy initiative, realistic simulations of decision-making, information processing and critical thinking are of paramount importance to be successful. Such an achievement, I believe is obvious in the quote above, taken from Nico's interview, where he directly connects his experiences of the game with incidents of his life. It can also be argued that the ability to contextualize knowledge can qualify as another skill developed by the game.

An important aspect of the connection of students with the game environment were the characters of the story, with whom students directly related and easily adopted their roles.

P1: Is he good? Why?

P3: Tell me something good about him!

P2: He is doing art!

P3: No, come on!

P2: Look at him, he is good! He is a good character!

P3: No chance to be good, trust me!

P2: You have no idea (Obs., T3, 290216)

It can be argued that the connection of students with the characters of the Play2Prevent seems to be a skills capacity building process. Students deploy their critical thinking and personality judgement skills to assess the attractiveness and their connection with the game characters.

R: Did you learn something that you could apply to your life?

S: Yes, basically how to choose and make friends. (Int., T2, GI, 230316)

The affordance of the game design and story to connect students with the game characters is a smart touch, which effectively contributes to knowledge and skills development. By associating themselves with the game characters students-thoughtfully gain experience and understanding of the importance of health literacy issues. Essential to this progress is the connection of the game's characters' attitudes and actions regarding challenges students face in their real lives.

> R: Tell us a few things about your experience with the game, how did you collaborate and play?
>
> S: It was very nice and linked with our lives, like the issue of sex, for example.
>
> R: Nice! So did you learn anything that you would transfer to your life?
>
> S: Yes, of course! You have to be careful of people and understand their character, like we did in the game, since you don't know how these people could influence you, especially in our days. (Int., T3, FD, 280316)

Another important educational aspect of the case study was the opportunity for collaborative and negotiated play, also a critical element of social constructivism that the game and implementation design provided. Students positively emphasized the emergence of a peer to peer learning process, which, as they also argued, contributed substantially to their ongoing engagement with the game play, the construction of knowledge, and the development of specific skills:

> To be honest it was extremely pleasant to be able to collaborate with other students, and not be alone with the screen and try to think by myself. There were themes that I didn't know and had no experience of them, but other members of the team did, and this is how we progressed at different stages. Overall, it was a great experience, especially the team work. I have to say, that the game itself was very educational on things related to alcohol and sex, which are parts of our lives, so I wouldn't play this game alone. (Int., T4, CP, 280316)

Students highly appreciated the content knowledge, as constructed through negotiated play and triggered by the game's learning themes. Also, students argued about the importance of contextualizing acquired knowledge, and applying it to their real-life, and even transferring it to the wider network of friends. This potential of sustainability and multiplication of health literacy knowledge and skills of people beyond participating students, can be considered one of the great achievements of this game implementation. I also believe that this potential exists due to the high level of contextualization and the real-life connections of students with the themes of the game.

> R: Are the things you learned something that you will apply to your life?
>
> P: Definitely! The knowledge we received from the game has become part of our lives.
>
> R: Do you think these things would be more relevant later on in your life, or will you apply them now?
>
> P: No, I think it's better to learn them at this age, to be careful in the future.
>
> R: Is there something in the game you will use now, I mean something that…?
>
> P: Maybe, yeah! In 2 years when I will drink alcohol, I will know what to do. Also, because these issues are for safety I will also share them with my friends!
>
> R: Do you think these are important for your friends to know?
>
> S: Yes! If I want people around me to be safe, I will advise them in differently ways based on what I know, and what I learned from the game. (Int., T5, DA, 210316)

In games that intend to develop health literacy skills, the opportunities they offer for authentic learning, contextualization and transferability of knowledge are indicators of success. What we analyzed and experienced up to now, the *Play2Prevent: Elms Street Stories* game takes a positive mark. Students convincingly argued about the opportunities they had to realistically engage in the game's narrative, to get attached to characters of the game, and to connect their negotiated play experiences with real-life experiences, in a social constructivist context. Nevertheless, as argued in previous sections, the game design and follow-up of the story appeared to have shortfalls, as students would have liked to see a variety of challenges and a more adventurous game ecosystem. Wrapping up the discussion in this section, the game, according to the students and implementation observations, did generate motivation, understanding, knowledge and skills that students could potentially transfer and use in real-life contexts.

The affordances of the game play design and mode provided opportunities for educational collaborative engagement

The concept of collaborative play and its educational potential is central to this research. It can be argued that one of the innovative elements of this research is to test a mobile videogame in the context of face-to-face team work. Moreover, organized collaborative play through the use of a game on a mobile device is an unusual case for Cyprus, not to mention its context on sexual education. Therefore, it has been a challenge to see how students would reflect on it, remain focused on the learning objectives and maintain their ongoing thoughtful engagement.

As was foreseen, having the experience from implementation observations, students, during their interview, appeared enthusiastic about the opportunity they had to play this game in groups. They

considered this approach of game play to be educationally constructive and personally engaging, motivating and entertaining.

> R: How was your overall game experience?
>
> P: We learned a lot and I enjoyed the collaboration. I liked the fact that we all had to listen to each other and work together, to be in the position to understand each other, why take these choices, and care about what they think. It was a very pleasant experience. (Int., T4, EC, 210316)

Although the game was designed for individual play, the vast majority of students, during their interviews, stated that they would only play this game in a collaborative mode.

> R- Ok, did you enjoy playing the game with a team or would it have been better if you played individually?
>
> P- It's more fun with partners; I wouldn't like to play this alone.
>
> R- What would be the difference?
>
> P- Ok, maybe it's slower when you play with the team but it's more fun. (Int., T4, EC, 210316)

Students highly appreciated the teamwork, and the entertainment this experience offered them. Although they did note that collaborative mode delayed the play progress, since teammates needed to go through decision-making, the attractiveness of playing the game as a member of a group, surpassed any time-limitations of teamwork. This argument was also evident when students felt the need to compare it with previous experiences they had when playing the game individually.

> In other games I played, I just chose a character and guided it to different missions, I had to think alone and take decisions. But in the game we played here, it was nicer, you could discuss with your friends and collaborate, complete missions together and have fun. (Int., T4, CP, 280316)

An important outcome of the analysis was also students' perception that the game design and format was highly supportive of collaborative play mode, referring specifically to the challenges of mini-games and the different thematic fields they covered.

> And I think that the mini-games had a lot of collaborative work we needed to do because we all put down our ideas and sometimes disagreed, but we needed to agree in the end! Also, friends in the team knew different things about the game issues and we needed to discuss them. (Int., T2, SS, 290316)

Collaboration, as designed for the case study implementation, and supported by the game format, infused an enthusiasm in the team's play process, almost in every session, even though some students continued complaining about repetitiveness. I believe collaborative play was the driving force behind implementation and the primary element for students' ongoing engagement, having also in mind that many elements of the game were demotivating. It was amazing to see the teams' bonds deepen, how students built up their communication, and new forms of collaboration evolved. One of these new collaboration forms was intra-team collaboration. The groups between them started to consult each other, a progress, which in my mind, demonstrates skills of flexibility and adaptability to the game's challenges.

> Students seemed to have the same enthusiasm as on the first day. Team 1 now seemed to have developed a more inclusive process of decision-making. Also, other teams seemed to value collaboration more, or learned how to collaborate. Team 4 composed of the 3 girls, remains the most enthusiastic, and best comprehends the game, while they never stopped discussing their options in the game. Another important aspect of game implementation is that the teams also collaborated with each other. Especially when a team moved ahead, other teams asked for validation or held onto their decision-making process. Teams cheered every time they completed a stage and, mostly, when they reached the stage of having 3 stars. For T4, that stage was when Kayla got pregnant and they had to take decisions. It was difficult for them to get 3 stars at that point, but the challenge deepened the team's internal and external collaboration in order to reach success. (ObsNotes, T4, 100216)

As students moved on to the levels, more quality and content was attached to their collaboration, as they felt more comfortable to share and discuss various ideas and perceptions.

> Player 1: What is that? No, no, noo! In the pool! I think staying in the pool is the right decision.
>
> Player 3: But there are no key points.
>
> Player 1: Oh my God, you're crazy, do you see any key points? Stay in the pool, I think it's the right decision! You need refusal power to do this.

Player 2: READING THROUGH THE GAME INSTRUCTIONS

Player 1: I think we should choose, “He wants me to get high with him”! I would do that!

Player 2: Let’s skip and do something fun instead! Heyyy, I feel the power!

Player 1: We need to choose! I like the fun part!

Playe 2: Nervous, illegal and health.

Player 1: Yes!

Player 2 What else? These 2 look very good!!! Owo!!

Player 3: Are you nervous…I don’t know if you are doing this for the first time! (Obs., T1, 150216)

Such direct discussions among students started to emerge as of the 2nd implementation session. Between them, at least, they comprehended the importance of collaboration and opinion sharing to proceed with the game, developing, at once, their negotiation and critical thinking skills.

Students, at this age, already have different experiences with regards to sex, alcohol and drugs. Such issues are completely absent from Cyprus’ formal education system, consequently kids at this age usually learn from each other or via the internet. For this reason, opportunities for peer learning are highly valued by students, therefore they esteemed the current game in positive ways.

R: Tell me a few more things about your relationship to the other members of the team. How did you communicate?

> P: As I said before, through the game you could see what was on everyone's minds, each other's general knowledge and knowledge about sexual education, alcohol and drugs. We learned from each other, as well as becoming connected as friends in real-life. We are more open to each other and trust each other now.I think the team was the most important thing and what kept the fun and game going, yeah! (Int. T5, DA, 210316)

As witnessed from Demos' description of interactions within the teams, students, beyond knowledge and skills, also developed social relations, an outcome that will also be discussed extensively at Assertion 3, and social trajectories.

Concluding from the above, both the game and intervention design are critical factors in promoting collaborative play. As, students argued, the nature of the mini-games, the thematic focus of the game, and the team-based implementation of the game supported their collaboration in playing the game. Drawing from the above analysis, gaming experience in teams generates motivation and empowers the attractiveness of the educational process. Consequently, we see the development of a peer-to-peer learning process, and skills related to communication, negotiation and critical thinking. Although students pinpointed some gaps in collaborative play, such as the slow gaming pace, and the game's design, which were characterized by a repetition of challenges, the enthusiasm that came with the teamwork retained an ongoing thoughtful engagement.

The game's design and affordances supported the development of specific health literacy skills

The primary objective of the educational game *PlayForward: Elm City Stories* is to empower health literacy skills of lower secondary education students. Although the game was designed for individual

play, in this case study, we implemented it in a collaborative mode. The aim of this shift was to investigate the potential development of decision-making processes and skills as integral parts of health literacy. This effort to elevate decision-making skills was also recognized by students. As they stated, they understood that the overall implementation provided opportunities found in "trial and error" and experimentation that assisted in developing their critical thinking and problem solving skills through teamwork. More importantly, they cheered for the game design and format affordance in promoting the skills abovementioned.

> S: It was really helpful, I mean this trial and error process of the game, because the game gave you the opportunity to make an error and correct it later.
>
> R: Was it helpful for you or would it be better if you made an error just to restart the game?
>
> P: It was definitely helpful because if one of us made a wrong choice then we wouldn't be able to replay that part of the game, and that team member would take the blame for it at the end of the game. So replaying the game, by keeping us close to the section where we failed, would actually help us to collaborate more, and think more carefully about the next move. It's like we learn from our mistakes, and don't repeat them, that's all. (Int. T5, DA, 210316)

The experimentation opportunities were a vital element of the overall game design and mode of play, as was put forward in the mini-games challenges, which students highly appreciated as a learning process. This characteristic of the game also contributed to students' ongoing engagement,

empowering their collaboration, motivating them to try alternative solutions, and building their strategy and visioning skills.

Player 3: Because there is someone saying we should follow him to the party, and he is a good kid, should we follow him and lose our score?

Player 1: So shall we put this one here? Where it talks about the party?

Player 2: Did you understand?

Player 3: Who says we should party?

Player 1: Shyanne

Player 2: Put her there.

Player 3: Boyfriend and best friend.

Player 1: So you have to choose this.

Player 3: Make him a boyfriend.

Player 2: Not you!

Player 1: Seems ok! You try, too!

Player 2: Let's put the boyfriend further down. Let's add "Seems ok" by the boyfriend because we will lose more.

Player 3: Yes!

Player 1: Let's not lose again! (Obs., T4, 090316)

As can be observed from the above incident, and the following one, students deploy critical thinking and negotiation skills, along with elements of leadership skills, to reach a correct decision, which validates the previous statement of Demos, regarding skills development and game design.

P3: No, I haven't finished yet! We need to get some more friends! I just want to get to 5. I need more friends. All ratings are very low. Which one is high? Let's do the health one because maybe…

P1: Oh, this is easy to get!

P2: Let's do them all now so we are prepared later on! (Obs., T2, 220216)

Collaborative play in groups also gave a sense of responsibility among students in relation to the rest of the members of their teams, since a wrong decision would affect everybody's progress within the game. This sense of social responsibility is critical for a health literacy skills development. In this context, students tried to thoughtfully and actively contribute to the team's decision-making process, resulting in the correct choice for the next move. Consequently, the play mode in teams, as well as the structure of the game, empowered students' interaction, contributing to the buildup of communication, decision-making and critical thinking skills.

R: Do you think the gaming process generated any kind of skill?

S: Yeah! It generated skills for decision-making because, in the game, someone wouldn't just press random buttons and do whatever they wanted, but would have to discuss with each other and take decisions. They would have to think before they

> pressed the button, actually having to decide which choice was right, even if both choices seemed correct. They would have to think which option had the most disadvantages and which the least advantages, and then act together. So this gaming process generated a lot of skills. (Int. T5, DA, 210316)

The game design and its associated affordances, along with negotiated play, supported the development of health literacy skills. Such skills included negotiations, problem solving, critical thinking, collaboration, leadership, planning and visioning. The game provided multiple opportunities for experimentation throughout its mini-game challenges, while the teamwork- based approach developed a sense of social responsibility among students. This framework empowered the thoughtful and dynamic engagement of students in game play. Contrariwise, as will also be discussed in following chapters, the ongoing trial and error approach of the game, in the long-term, became repetitive and demotivating for some students. Additionally, on some occasions, within teams, the person that evolved as leader was left alone to play and take decisions. As will be argued in following sections, in these types of implementation a facilitator might be needed. Nevertheless, despite the abovementioned shortfalls, students felt that a number of skills related to health literacy were developed due to the game's affordances.

The game should have provided a variety of play modes and challenges designed to secure the ongoing thoughtful engagement of students

During students' post-implementation interviews, most of them emphasized how they started the game with enthusiasm and great interest. However, as they progressed from level to level playing the mini-games challenges, the positive feelings progressively minimized. The cause of this interest downgrade was the repetitive play mode and game's challenged or challenging? format.

> … at first the game was interesting and fun, but later when we played daily it started to be repetitive with not much reflection from my teammates. We had to do the same things over and over again. Some things I know come as part of an educational game, and you have to learn from it, but some information you can also get from the internet; we don't need to do the same thing all over again… (Int., T1, SS, 280316)

The statement above from one of the students on initial enthusiasm, similar to other students' statement, was also validated by observations from my field notes.

> The participants seemed to be very enthusiastic with the game. Some of the students compared it with the Pro Evolution Soccer Game, and could play it for hours. They discussed, with excitement, how they enjoyed it, and that they did not find it boring at all. (ObsNotes, T1, 240216)

However, as noted by Stavros (Int., T1, SS, 280316), the repetition of challenges and mini-games forma, generated a negative perception towards the educational game; this became obvious in later sessions. Moreover, the repletion within the game limited the attractiveness of its learning process, as students started viewing it as another mainstream course, where its core objective was to pass over information, and which, anyway, is easily accessible through the internet. The monotony of the format throughout the game, and the focus of the learning process on data and information transmission, raised questions on the usefulness of the game.

> If the game existed before the internet was discovered, let's say years ago, I think it would have worked, but now, even children of 8, can go on the internet and find out stuff about this. I don't think this type of game works. (Int., T1, SS, 280316)

Apparently, Stavros would have appreciated a more adventurous game with more challenges, where probably information and knowledge would be transmitted in a more playful manner. As he argued, accessing the internet would be more effective to obtain information provided by the game.

In the recorded observations and transcript discussions among teammates, the frustration generated from the repetition of challenges gradually became obvious and clear within students' interactions.

> P2: Let's check this!
>
> P3: Is it open or something? Is it upside down?
>
> P1: We found them all!
>
> P2: Pay attention!
>
> P3: But I already did this too many times!
>
> P1: We are doing the same thing again!
>
> P3: Oh yes… (Obs, T1, 070316)

From the discussion above between members of Team 1, elements of disappointment can be identified among students, after trying the same challenge too many times. This feeling progressed in alignment with the game levels, minimizing students' interest in the game play.

Another limitation of the game which also created frustration was the long discussions between the game characters, within the game's narrative. These discussions, although building up the game's scenario and providing some health related information, the relatively long absence of students' integration during these characters' dialogues, contributed to a disengagement towards the last sessions.

> Some talks and arguments of the characters were taking too much time! The same was happening at most of the game stages. This made the stages too long to complete, and it was boring for us. (Int., T5, CP, 210316)

Merging the abovementioned argumentation, it becomes apparent that the absence of multiple play, the long game-students' interaction gaps, and the over-transmission of hard core data and information (mainly through long dialogues between game characters), limited the attractiveness of the game and students' engagement with the learning process.

> So ok the overall experience was interesting. We learned quite a few things. But some levels were too much… for example we needed to go back and forth so many times, and then try the same things all over again. This was tiring, at some point. I think this is a game you only play once. (Int., T1, EC, 210314)

Focusing on the initial statements of students about the game, and the enthusiasm at the first game levels, and as we are going to argue in the following section, there is an overall positive perception about the game among the students. Nevertheless, the game itself, as a learning medium, presented serious limitations in empowering students' educational experience, due to its repetitive design and content focused on information.

The technical affordances of the game such as sound, usability, rating system, and visuals, are vital features that defined the quality of play and learning experience

Analyzing students' post implementation interviews, it seems that they asses the technical affordances of the content of the game, related to design, graphics and sound. As will be argued in following chapters, students prioritize their reflections and criticism on the affordances of the game that allowed them to collaborate, and on the scenario/narrative. Nevertheless, visuals, sound and usability, did influence students' learning and play experience, the game's attractiveness and students' game flow and engagement levels.

> R: Ok, cool! Now tell us some positive aspects of the game.
>
> P: Ok, the design was very nice! The graphics were ok, there are games with better graphics but for this game, these were ok. I also liked the sound.
>
> R: What was your overall game experience?
>
> P: OK, it was a clear game and that helped us learn!
>
> (Int., T1, EC, 210314)

Students appreciated the connection of voice and sound with the game's narrative. Many students made a special reference to the sound of the game, which they considered to be part of both their entertainment and learning process.

> I wanted to hear the story, sometimes there was noise in the room, but in my opinion, we learn by listening to the story; also, the game is more entertaining, that's what I think. (Int., T1, SS, 280316)

In addition, some students simply liked the sound/music of the game, which made the play process more enjoyable.

> P1: Turn the volume down!
>
> P2: No, I like it!
>
> P1: You like the sound?
>
> P2: Yes, I do!
>
> P3: Come on, it's a very nice sound! (Obs., T3, 290213)

Overall, students appeared to have a positive opinion about the technical characteristics of the game, and, more importantly, they believed these features enriched their play and learning experience.

> R: Nice, so how do you compare games with other games that you play?
>
> S: I liked it, it was pretty and I found the environment creative; I liked the story. Compared to other games it could have better graphics, but I liked these ones, too, and I really had a lot of fun and learned a lot. (Int., T1, SS, 280316)

An important technical characteristic of the game, which wasn't anticipated, was the game instructions and help functions. It seems that students, and, assumingly, all gamers, at least, at the initial stages of the game, need some support on its functionality and play requirements. This feature also relates to the appearance of a learning curve, until students become fully engaged with the game, which will be discussed in a following section. In this context, some students made a special reference to the importance of the game's instructions, and how these would support thoughtful play.

> We found it at the end of the game after we discovered the instructions of the game. In the beginning we didn't understand what we were pressing and why, and time was passing. We also thought that with a strike you lose one star. But when we understood the game and completed a stage, we all screamed "Yees!" (Int., T4, NM, 210316)

It can be concluded from the above quote that understanding the game process and the purpose of the game's functionalities and scenarios, empowers conscious and thoughtful play and learning.

Another important feature of the game was its scoring and rating system. As some students noted, this feature empowered their engagement in the game. Additionally, the scoring and rating system contributed to their ability to reflect and comprehend the complexity and challenges of different themes and missions of the game. This reflection developed a task-oriented and thoughtful play process.

> R: What was the most difficult part of the game?
>
> P: It was a stage referring to sex where we had to get 3 stars so that the game could move on. (Int., T2, GI, 230316)

Moreover, the rating system and scoring led the game players to strategize and plan their moves, building up their critical thinking, collaboration and visioning skills.

> P1: Yeah!
>
> P2: Good job!
>
> P1: Show man!

P3: Owo! Both at the same time!

P2: We need to get 3 stars! We need to get 3 stars to go to the next stage! Let's be careful with our choices!

P3: OMG!

P1: Come on 3!!! (Obs., T5, 220216)

Finally, the scoring and rating system within a game constitutes the immediate awarding scheme of the students' successes, and builds up on the overall game attractiveness and students' enthusiasm, providing a direct reflection on students' decisions within the game story-line. Moreover, the scoring system supports students' direct metacognition of their decisions and actions, while it guides students' scaffolding of knowledge.

Aligning the outcomes of the above data analysis, it can be argued that students found the technical affordances of the game attractive, adding up to the overall learning process and experience. Moreover, some of the technical characteristics of a game contributed to critical thinking, visioning, collaboration and negotiations skills development. Overall, the technical characteristics of the game supported the flow of the gamers and their ongoing engagement. Nevertheless, as students emphasized in many instances during their interviews, and as I observed during implementation, the game appeared to have some design and technical shortfalls. More specifically, there is a limited diversity of play modes, excessive repetitiveness of challenges, and an overflow of data and information.

4.3. Assertion 2: Game and Decision-Making

In the 2nd Assertion drawn from the data analysis, I argue that, "students believed that their participation in the *PlayForward: Elm City Stories* mobile videogame implementation case study, facilitated their engagement in decision-making, and developed their communication and critical thinking skills in a conscious and comprehensive manner; however, in reality their participation in decision-making didn't illustrate the negotiations of ideas". The assertion is broken down and discussed in 3 subcategories, referring to the support of the game to the group's decision-making process, the development of skills in a conscious and comprehensive manner, and a limited negotiation of ideas.

Students believed that game case study design and implementation supported their engagement in group decision-making processes

The design of the game case study intended to test how negotiated play would build up group decision-making practices, among students. Furthermore, I was also interested in testing which ways the *PlayForward: Elm City Stories* mobile videogame provided space, and encouraged decision-making in a thoughtful manner for students. Therefore, my aim here is to analyze whether and how students comprehended the decision-making process, as part of their engagement in the game.

In this context, students greatly appreciated the opportunity they had to freely exchange and negotiate different views and opinions among them, through game play.

> R: Was the fact that you played the game as part of a team a positive experience for you? What is your opinion?
>
> S: It was a very positive experience, especially the fact that everybody could express their opinion. (Int, T2, DF, 280316)

It is evident in the analysis of the data that students were consciously and actively engaged in negotiations concerning decisions they should take, and exchanging roles and tactics in their efforts to convince each other.

> R: What was usually your role in this process? Did you express your opinion or just listened to others?
>
> S: Yes, you do listen and think, and then you express your opinion, and if you really believe that you're correct you try to convince others, but you must also listen to others because they may be correct, too!

During this process, students appeared to deploy critical thinking and negotiations skills, both essential in group decision-making. Moreover, in their statements, they appeared to collaborate and respect other's opinions for the benefit of the group.

> R: In a team of three different persons and characters, how did you end up taking a decision?
>
> S: We discussed a lot, and even if we disagreed about something, each of us tried to convince others; if the disagreement was ongoing, we eventually did what the majority wanted. (Int, T2, GI, 230316)

Students acknowledged that the game provided the settings for negotiated play and group decision-making to evolve. Additionally, decision-making was also encouraged by the game's narrative. Students realized very soon that a decision would affect their team's future progress in the game's story so they had to take thoughtful decisions for each next move, deploying, at once, relevant skills.

We witness here a development of new understandings and meanings related to making decisions, through negotiated play and collaboration; these are characteristics of the social constructivist pedagogical approach.

> S: A very important aspect of the game is decision-making. To make decisions you have to include all three teammates . What I mean is that you need to have good communication with others, and to understand where a decision leads you. You also need to convince others to agree with you. All this is because decisions affect the other members of the team, too. So, I can't just make a decision for myself! If the decision is wrong, it will be my responsibility as well as the others, of the team as a whole!
>
> R: So do you see some skills being developed through this process?
>
> S: Yes, especially teamworking and communication, developed to a very high degree. (Int., T4, CP, 280316)

Students in the interviews argued that the decision-making process was mainly encouraged in the mini-games challenges of the *PlayForward: Elm City Stories* game, where they had to negotiate a true or false answer, exchanging opinions between them.

> R: In which cases during the game, did you have to enter a decision-making process?

> S: In the sections where we had to decide, "True or False or Opinion", if you were wrong you couldn't get three stars, so in those cases you needed to make a decision on the perfect answer and why that was the best answer. (Int, T2, GI, 230316)

Additionally, as registered in my observation field notes, students debated, negotiated and made decisions on building up the characteristics and personality of their avatar.

> Students are collaborating, debating and are sometimes persistent and obstinate with their answers. They seem excited and devoted to the game. The screen task here is again to prioritize some values (i.e. health, happiness, money, food, friends, school and family). Some of them have strong opinions about protecting a value they consider to be important, and are not willing to allow the particular value to lose its position. (ObsNotes, T5, 220216)

It was a challenging process for groups to establish a common ground in such a variety of themes, options and opinions provided by the game. Many times, negotiations and a decision-making process didn't reach a consensus, and voting had to be deployed. An excerpt from a group interaction illustrates this progress in one of the groups.

> P3: Hey! What are you doing?
>
> P1: Let me think!
>
> P3: You will negatively affect the happiness and the….
>
> P2: I will not affect the happiness!
>
> P1: No, No, No!!!!
>
> P2: This is the best we could do! There isn't anything else to do!

P3: We saw it!

P2: We did see them, but they are not the same as before!

P3: Wait, let's vote! (Obs, T5, 220216)

It became evident through the analysis of the data that students were flexible in finding their way through disagreements, conflicts and friction, in order to reach a final decision. It seems that this build-up of practices, skills and adaptation to game challenges was something directly connected with the specific game. Particularly, this framework was facilitated by the interconnection of decisions with the game progress, as well as the development of team/social responsibility. This is something also emphasized by Demos in his post-implementation interview, who recognized the difference of this case study to other instances of collaborative game play he was involved in.

R: What kind of games do you play?

S: Mostly, first person shooting or even some online multiplayer games, and yeah, I like playing games with any theme with my friends .

R: Are there any differences between this game and the games you play?

S: Yes, I never actually try to get in decisions like I got in this one.

R: Ok.

S: That's why it was a really fun experience because it was the first time I experienced something like this, to play on an iPad with others.

R: So you found this process new and interesting?

S: Yeah!

R: Which things did you enjoy-most in the game?

P: The thing I enjoyed most in the whole process, is when we finished a big chapter, knowing this happened through the collaboration with others. We started chapter 2 sessions before, and in these 2 sessions we developed experience on how to work together. And coming towards the end of the chapter and completing it was an exciting moment and felt nice. (Int., T5, DA, 210316)

However, despite the positive opinions of negotiated play by the majority students, some considered this process to be a limitation for a gamer. The friction between students, the long duration to make a decision, and the probable boredom of some members of the groups could substantially limit the implementation of decision-making.

I think for myself about how to find the objective on my own without the help of somebody else. This way is better for me because if you play with 2 or more people, maybe you'll face trouble between them, and so there will be delays in the game. And eventually, nobody will actually make any decision. And maybe someone will get bored because you can't have too many people touching the screen. (Int., T1, ST, 280316)

However, I verify once again that the majority students appreciated their participation in the case study in a multiplayer mode, since they enjoyed group negotiations and decision-making processes. This type of engagement was empowered by the case study implementation design and the game format. The student below notes that he had fun playing the game in this mode.

> R: Did you enjoy playing the game with the team or do you prefer to play it alone?
>
> P: No, playing with friends is always more fun, I really like that because we manage to see everyone's opinions and views; I will never manage to play this game alone. (Int, T2, GI, 230316)

More importantly, students believed that their engagement with this mode of game play, built their capacity and knowledge in health literacy skills, such as communication, collaboration, and critical thinking.

> Decision-making is like advising each other and proposing different kinds of opinions. First, we agree, then we disagree, and then we find a common ground. And I think that mini-games in the game that we played have a lot of collaborative work and because we all put an amazing work together, if all of us agree or disagree we eventually find common ground. We learned different things with friends on health issues, played the game, and the major point was that all people need to play this game. (Int., T1, SS, 290316)

Building on the above evidence drawn from various data sources, it can be argued that students understood their participation in the game case study as an engagement in a negotiated play mode that led to group decision-making processes. This engagement in decision-making, for the majority of students, was conscious and thoughtful. In this context, the quality of students' engagement supported the upgrade of their health literacy skills, such as collaboration, communication and critical thinking, along with the development of a sense of team/social responsibility.

Students felt that they developed decision-making skills in a conscious and comprehensive manner

Students argued that they were aware of the term, "Decision-Making", and that they could recall other instances in their lives when they entered such a process. This past engagement, however, was not structured or based on a thoughtful process, but was rather an indirect element of their day-to-day life, inside and outside the classroom.

> R: Nice.. have you ever been taught decision-making processes, either in school context, or outside, directly or indirectly?
>
> S: Yes, maybe indirectly by my family throughout the years, through school subjects such as physics or biology, where you learn critical thinking. (Int., T5, CP, 210316)

A similar statement was also made by Stavros. He emphasized how he was, for the first time, consciously engaged in a decision-making process during this game implementation.

> I think the decision I made before was with my parents and with what courses I would choose for school, but it came just like that. It's the only thing I can remember about a decision-making process. In the game and because of its general concept, I was engaged in my own decision-making process for the first time. (Int., T1, SS, 290316)

In the above statements, ignorance can be identified on behalf of students with regards to whether they actually engaged in such a process before. Nevertheless, what students do realize is the

importance of building decision-making skills for day-to-day life, and how the game actually supported this process.

> R: Cool. How important is decision-making to your life?
>
> S: Decision-making is really important because if you don't make decisions you won't move, and in life we have to think before we act because when we make mistakes we mustn't repeat them, and maybe they are fact that and have that sometimes. This game taught me that I should think a lot before making a decision. (Int., T5, CP, 210316)

Additionally, according to the students, they hadn't been involved in a pre-design learning initiative related to decision-making skills. Such a statement demonstrates the shortfalls of the formal education system.

> R: Did you play games or take other initiatives in the past which led you to a similar process of decision-making as part of a team?
>
> S: No, not like this! (Int., T5, DA, 210316)

In the same vein, Christina noted that constructed and thoughtful engagement helped her to reflect on her involvement, and felt that she entered in the buildup of decision-making skills. This also demonstrated the deployment of ~~a~~ metacognition practices by students.

> R: Did anybody teach you anything about decision-making processes?
> P: Never! I don't remember being taught anything. Not from games. I play different games and maybe I try to take some decisions in life. But in this game, it was really

> clear how to play and finish the game, all planned to do this! Maybe not in the very beginning, but it taught me a lot about decision-making and what I need to do to make a good decision. (Int., T5, CP, 210316)

Non-thoughtful engagement of students in game play and decision-making, limits their understanding of the impact of the learning process. Moreover, the vague participation of students in non-task-oriented learning processes, with the use of games, has limited influence on their skills development, as is clearly argued by a student, in the quote below:

> S: The important thing is for someone to teach you something or for you to try to learn something, but also you need to be actively engaged to learn, you need to be part of decision-making processes in order to develop that skill. (Int., T5, CP, 210316)

The development of skills was a progress that almost all students noted in their post-interviews. I found it extremely interesting how students connected, in a considerate manner, the case study design and game format itself with the advancement of their decision-making skills and a metacognitive self-reflection. This is also evident in the comparison of their engagement to other games.

> R: Do you think the gaming itself generated skills for decision-making?
>
> P: Yeah! It generated skills for decision-making; for example, someone in this game would actually experience the decision-making process. Players wouldn't just press random buttons and do whatever they wanted as with other games. They would have to stop and think before they pressed the button, actually they had to make a decision, which choice is right, and even if both choices seemed correct, we

> acted together to make a decision. So, yes, this process generated a lot of skills. (Int., T5, DA, 210316)

Building on the statement above, it can be argued that students believed that their active and thoughtful engagement in a negotiated play developed their decision-making skills. Such a perception is also evident in some of Alexis' replies during his post-implementation interview.

> R: Perfect. Do you think that the game helped you develop any skills?
>
> P: It both improved and tested some of my skills, especially in decision-making.
>
> R: Like which skills in decision-making?
>
> P: Mostly, how to talk to more people.
>
> R: Collaboration, critical thinking?
>
> P: Critical thinking, yeah, for sure!. I learned how to think, how to communication, how to talk to other people, yeah! (Int., T5, AA, 280316)

The skills associated with effective collaboration, negotiation and critical thinking appear to be the primary skills, tested and developed though game implementation. This can be argued based on the observations during game play, and the interaction of students within their groups. To demonstrate the abovementioned statement is an incident in which students discuss what decision they should make based on the facts and evidence provided through the games' narrative.

> P1: You need to find evidence first!
>
> P2: Ahhh!

P3: So, who are we?

P2: Wait we need to read this first.

P1: You see, it says other things here!

P3: I think we should confess.

P2: See this?… I will add the reading clue.

P1: We found the watch.

P2: Wait a minute..

P3: We choose these! (Obs., T4,100216)

In this incident, we witness discussions between students triggered by the game, in which they negotiate what option to follow to complete a mission in the game. Also, I noticed elements of critical thinking by students, where they try to assess the data and evidence they accessed in the game, so as to make the correct decision.

These kinds of incidents, throughout the game play, were also described by students during their post-implementation interviews. The development of a set of skills associated with decision- making is demonstrated in the quote below.

R: Where did you implement decision-making processes in the game that you played? In which cases?

P: Where we had to find some clues and to consider which clue is more appropriate, and then when we had to engage in some activity and debate. This really made me

> think before I acted because if I found something wrong, I would not be able to continue, so it does make you think a lot before you act. (Int., T5, DA, 210316)

It is evident in this quote how the game itself guided students to develop decision-making skills, realizing that their choices would affect their future course within the game.

Engagement in task-oriented collective decision-making process also encompasses a range of other skills that are vital for health literacy, such as leadership, and collaboration.

> R: What does it mean to make a decision? And what skills do you need to have to make a decision?
>
> S: Maybe some leadership skills, to stand by yourself and make your own decision, courage maybe, to believe in yourself, to listen to others, and not decide on your own. (Int. T4, EC, 210316)

The case study implementation was a mindful design of an investigation of the particular game's impact on students' decision-making skills through negotiated play. Students, on many occasions, argued that their engagement with the game had a positive impact on their ability and capacity to think critically, visualize, and communicate within their groups.

> R: Nice. Just think from the beginning to now of all these experiences you collected through your participation in this case study. What decision-making skills did you develope while you played this game in a group with other students.
>
> S: I definitely developed my collaboration skills and learned to see and listen to the things my friends said, and their different points of views. I also improved critical

> thinking, and saw how the story progressed and actually saw what can happen to make it easier for me, to see stuff in the future, and how to act on them, this really taught me a lot. (Int., T5, AD, 210316)

Building on students' interactions, views and statements, it becomes apparent that they believe task oriented, conscious and thoughtful engagement in negotiated play would alter their decision-making skills (collaboration, communication, visioning, critical thinking and leadership).

Despite the enthusiastic reflections of students on their engagement with the game and the group decision-making process, their practices didn't illustrate negotiations of ideas

Although the decision-making process was an integral part of the game, in reality there were no substantial negotiations, between students, of ideas or concepts related to the game theme. Instead, the data analysis showed that students were mainly occupied with debates on how to respond to close-ended questions, limited in most of cases to the "True or False" format. This does not imply that the game hindered the development of certain skills, as argued in previous sections. However, it did limit the deployment of argumentation and rhetoric by students, enriched health literacy knowledge, opinions and perceptions.

> Player 1: Okay, shall I press it? Here we go...
>
> Player 2: Did we choose false here or was it just an opinion? It's false isn't it? You're right... okay!
>
> Player 1: Forget the condoms and the sex...

Player 2: Come on, let's press it and see….no, it doesn't fit... wasn't that the point? Anyway, we need to try again!

Player 2: You are so wrong, I don't believe you.

Player 1: Initially we'll choose the first one. .. and if we get another plus two, we'll finish it.

Player 2: Here, there is a plus two.

Player 1: No… No… For real! AAA, it's here! Oh my god, it's here! It was false, but which one is the right one? (Obs, T1, 150216)

What can be asserted from the quote above is that, although students faced many opportunities to negotiate issues related to the theme of the game, like the use of condoms during sex, students argued about random selections of answers, without contextualizing their negotiations or decisions. As will be discussed on other occasions, this was the result of ignorance about the question content, the repetition of challenges format and time-limitations.

Even in cases of disagreement, and being annoyed by format repetition, students resorted to the solution of one person picking the answers of the group, or directly going with the will of the majority.

R: Did you discuss things between you?

S: Yes, a lot of times. But ok, there were many occasions when one person played alone, just to lead the overall process, or because we lost many times and were just doing the same thing over and over again.

R: So how did you end up making decisions?

S: We were discussing, but after many times, we just chose what the majority or what one person believed was correct. (Int., T4, EC, 210316)

Moreover, based on some replies, students seemed to focus exclusively on "mechanical" collective decision-making, with the absence of any content-oriented argumentation.

R: Do you remember an example? One example in a serious situation where you needed to take a decision?

S: I remember once when we had to remember something. I think it was to increase our grades and I made choices of grades which affected other things, like help and family, whatever. I just made the worst decision; any case, we were going to lose our next steps.

R: How did you take the decision as a group?

S: Through conversations and voting, ok. (Int., T5, AA, 280316)

Despite the fact that the majority of negotiations among students were not directly linked to the game content, there were occasions when someone in the team was aware of a topic, and brought it up in the discussion. This appeared to be an effective peer-to-peer learning process among students, as they did value the knowledge of their classmates in the decision-making process.

R: Can you think of an example during your game play, where there were different opinions among your teammates, and how you ended up making a choice?

> S: If I remember correctly it was something related to pregnancy and hepatitis. One of our teammates, based on his experiences, said that it was not curable and the other said it was. So we were discussing this for a long time and in the end we learned from the game, what was true and what was false.
>
> R: So after that, was it easy to agree?
>
> S: I think if we had someone from the team that had played the game before and if we knew what we were doing, we would be more convinced and have a more direct opinion. (Int., T4, NM, 210316)

The quote above could be used as a validation for the importance of a contextualized negotiation process, where knowledge and ideas could be deployed by students to empower their negotiation positon, contributing to the quality of the learning process. As stated above, prior knowledge of an issue and its connection to real-life situations supported the negotiated play and the decision-making process. Also, something that will later be discussed is the absence of sex education related knowledge, due to the gaps in the Cyprus educational system, which was also a reason for minimal content and negotiation of ideas.

Concluding this sub-assertion, it can be stated that the game due to its repetitive format, based on True-False and Close Ended Questions, limited the opportunities for a negotiation of ideas and knowledge. This was mainly observed towards the last sessions, when many students became less active in the game play, and pressed buttons randomly. It has to be noted that the absence of contextualized negotiations doesn't imply the absence of skills development, such as communication, collaboration and critical thinking. Nevertheless, the importance of contextualized negotiations has

been emphasized by students themselves. In their interviews, most students described how they developed knowledge about specific themes (e.g., safe sex, use of drugs), as they were provided with opportunities to discuss these issues with their peers.

4.4. Assertion 3: Social Trajectories in Negotiated Play

The game and overall case study implementation design generated discussions and interactions not necessarily directly related to the game itself. Teamwork and negotiated play brought up issues related to students' everyday life and helped them develop their interpersonal relations. Also, triggered by the game themes, students discussed experiences they had related to health issues. This is, arguably, another important outcome of the negotiated play process, which led me to the 3rd assertion of the present research. This assertion states that "Negotiated and collaborative play in teams shaped social gaming trajectories, such as students inter-personal relations, self-reflections on students' own life experiences, and discussions beyond game themes." The assertion is composed of 3 different sub-assertions referring to participants personal interactions, self-reflections and real-life issues, and the analysis below will develop in these three categories.

The game play format, based on teamwork, developed the inter-personal relations of students

Unavoidably, after several weeks of collaboration, discussions, interactions and debates, students felt that they developed closer personal relations with their teammates, making new friends and getting closer to each other. Negotiated play appears, in this case, to be a catalyst in bringing students, who had no connections before, closer together, as participants came from different classes of the school. This outcome of teamwork and direct interaction in game play could be considered for implementation in environments with students of diverse background. Such an intervention could

develop mutual understanding among them and display appreciation for diversity of ideas and perceptions. An important aspect of such a positive interaction would be the design of an attractive and motivational implementation.

R: Did you, as part of the team, enjoy playing the game with others?

P: Of course, it was more interesting and fun to have partners.

R: How is that?

P: You get to know others, who they are, how they think, we learn to work together and collaborate.

R: So that is the fun part that you really like playing and working as a group?

P: Yes, we learned, we had fun, met new people and learned more about each other.

R: Hm, so it will be different to play this game alone with regards to the fun part??

P: It's also fun because you play with others and it's interesting to talk and understand others. (Int., T5, AA, 280316)

Beyond the influence of the negotiated play in having fun and making new friends, it was also important that the game's themes brought existing friends closer, opening them up to each other about sensitive issues. Discussing sexual education, drugs and alcohol from different perspectives, built up relations among teammates.

R: How was communication within your team?

> P: We had excellent communication, I really enjoyed talking with my teammates. In the team, I had one friend and another person who I didn't know. But as we moved in the game, we became friends, we are now more connected with other members of the team and my friend, too, and have opened up to each other. We talked about things from the game that are also our things and we learned from each other. (Int., T5, DA, 210316)

As they played students started to understand each other; which themes they were aware of, what skills they had, and how these could help them in the game, as well as in real-life.

> P2: Calm down, we are not in hurry!
>
> P1: I was sure about that! You guys should do the rest! Come on, you're both good at this!
>
> P3: Oh, look at her, she is not that pretty! Ok, you choose!
>
> P2: You'll find it, try, you know what to do!
>
> P1: Oh, my friends, we can all try together!
>
> P3: Are you sure about the next move! (Obs., T2, 220216)

Furthermore, the case study implementation took place as part of the establishment of the gaming club at the school, so many students with this common interest had the opportunity to meet and develop their friendship.

> I think I made a lot of friends because I found people that also like to play games! I can't just open a program or go around asking people if they play games or what their interests are in games. But with this process that we played, here, and with the creation of the club, I met other students from the school who like games and I didn't know that. We are now friends with many of them, and we talk at school and when we meet. (Int., T1, SS, 280316)

The ecosystem of the game study implementation, including the negotiated play mode, the game content and the school environment, supported the development of more personal relations among students. The active engagement in negotiations, to make a decision and complete game missions, deepened the connection among teammates. The game content opened up discussions about personal issues, bringing each student closer, and developing stronger bonds between them. The game implementation itself revived the common interest of all participants in gaming, building up their off-class relations. This site-effect of the case study is an important and useful result that can be used by educators to build a team spirit among students, and generally, by leaders to empower the bonds of people in diverse social environments.

Negotiated play facilitated students' self-reflections on their life experiences, related also with the game content

The game play in a negotiated play mode, as well as game themes appeared to be relevant to students' lifestyle, as it triggered, on many occasions, discussions and self-reflections on real-life experiences. The content guided students to acquire the role of a game character in many mini-games challenges, and reflect on how they would react in similar situations.

P2: Basically, I don't know, are they thinking all of this at that specific moment?

P3: No, personally I think very differently! I think differently because it's not only his mistake but hers also.

P2: Yes, you are right.

P3: There is no right and wrong in this situation! They both are to blame!

P2: Right, I agree.

P3: I mean look at what happened? How did this happen now? It could be us!

P2: Look, she's pregnant, they have this issue now and it's not fair for anyone!

(Obs., T5, 220216)

The game's narrative also directed students to visualize their future, and how they imagined their personal life in several years.

P2: I like to play like this.

P1: Future family…Ok!

P2: No, go up! Is it a girl? Is it a boy?

P1: He wants a family! Is he gay?

P3: Exactly this!

P1: Maybe he doesn't want a baby! I don't want him! Live alone!

P2: I want this one with 2 children!

P1: 2 children?

P3: Where is their father?

P2: Here he is with his girlfriend!

P1: Oh, look at him!

P3: Press the chair!

P2: Ok, I will!

P1: Do you want to get married?

P2: I'll get married at 25 and will have a baby at 27!

P1: Perfect!!! Exactly that!!! Oh, they will have sex now?

P3: I want to get married once I reach 26!

P2: Ok, shall we continue?

P1: Yes, I like it! (Obs., T4, 240216)

Moreover, students commented on how they would judge characters, and what would define their relations and affections with their own family members. Particularly, the discussion on whether it's natural to love your father or not is a controversial issue in real-life, too.

P1: Why is he talking like that to his father?

P2: Maybe because his father is a soldier?

P3: Isn't it natural? Is it natural to love your father!

P2: Why do you say this? If your father isn't treating you well, would you love him?

P3: Ok, I don't know how I would feel but it's expected to love your father!

P2: Not if he isn't good to you! (Obs., T4, 240216)

This form of interaction appeared to be educative for the students, and contributed to the understanding of themselves and their thoughts. They seemed to appreciate the motivation the game inspired for discussions with their teammates on personal issues, and to learn from each other.

> The game gave me the opportunity to think about myself and actually develop my mind! To go through these issues and learn with others helps your personal life! Ok, entertainment games are more exciting and fun, but through educational games like this one, you get to think about personal things, too. For example, sex education teaches you about things, and then you try to think of what you did or what you may do in those situations. (Int., T1, SS, 280316)

The game format and the mode of play provided opportunities to students to self-reflect and visualize their present and future life, in what I consider to be an educative process, linked with the pedagogical framework of social constructivism. This context of negotiation and interaction between them has been another positive element of their participation in the case study, as they stated. The health literacy related themes triggered discussions on more personal issues, learning from each other, and revisiting their thoughts and perception on how they deal with certain issues in real life.

The game content and collaborative play mode produced discussions among students, which were irrelevant to the overall case study, but were interesting and informative for them

Perhaps it was anticipated that given the opportunity to play the game in groups, students would also be led to discuss issues irrelevant to the case study, but apparently relevant to them. This is another important outcome of the case study, and a positive side-effect of the learning process, as students acquire knowledge and understanding of additional themes beyond the ones directly relevant to the game. Of course, some discussions were not totally irrelevant, as they were related to technology issues and-mobile devises.

> P1: Since when is it like that?
>
> P2: Since Friday!
>
> P1: Can't Apple just give you access to it?
>
> P2: It's under the guarantee but it'll take 2 weeks to get it!
>
> P1: So we can't play that game now! It's not in the options either so I don't know what to do!
>
> P2: You might need to unlock something? And we can wait to see if Apple replies to this! (Obs., T5, 150216)

Furthermore, the game generated discussions on issues connected to its themes, such as movies with sexual content.

> P1: This room is like 50 Shades of Gray!

P2: The kitchen is gray!

P1: Do you know what 50 Shades of Gray is?

P2: Yes, I do!

P1: The 1st one?

P2: I haven't seen it!

P1: Ok, when you do, be careful you don't get caught by your mother!

P2: Really? Is she gonna cry?

P1: No! there's a lot of sex in it!

P2: Oh, really, sex?

P1: Shhh! Don't shout! (Obs., T1, 240216)

It was useful for students to get engaged in discussions beyond the game itself. One of the most constructive outputs of the overall case study is finding out that students use this implementation, in an interdisciplinary approach, to build their knowledge on other issues. Educators should facilitate negotiated play and learning, as this mode can build knowledge beyond targeted learning objectives.

4.5. Assertion 4: Opportunities and Challenges of Integrating Games in Education

The case study revealed a series of challenges and opportunities related to the integration of games in education, which, potentially, educators, instructional designers, policy makers and other

stakeholders should take into consideration. These challenges and opportunities have to do with the expectations and needs of students in terms of pedagogical and delivery modes, the capacity of students to play digital games, and the bridging of the dichotomy between formal and non-formal modes of education. In this context, Assertion 4 states, "Integration of games in education and health literacy initiatives, generates a series of opportunities and challenges, such as the attractiveness of ~~the~~ collaborative play and learning, the promotion of a customized/needs-oriented learning, the bridging of formal and non-formal modes of education, and the appearance of a learning curve, which students need to go through to become familiar with the game." The abovementioned assertion will be discussed in 4 different sub-chapters, referring to the potentials of collaborative learning and negotiated play, customized/needs-oriented learning opportunities, the crossover of formal and informal education, and the game's learning curve.

Students appreciated the learning process based on collaborative play, which adds to the overall educational value of the game implementation

The collaborative mode of the game play came up in many statements and claims in this data analysis, as a valuable, effective and attractive educational practice. The design of the case study based on group work and collaboration had a positive impact on the overall game implementation, empowering thoughtful engagement and learning.

> To tell the truth it was a very pleasant experience! I could collaborate and work with others. This helped me to learn new things I had never heard of before and continue playing and progressing through the game. I liked it very much, especially the collaboration! This was very educational and pleasant, at the same time,

learning and talking with my teammates on adult's issues like drugs and sex. (Int., T4, CP, 280316)

Negotiated play motivated students to build up on their existing knowledge and contribute in an educational mode to the team's progress through the game,. It is interesting to observe and listen to how students were bringing their own piece of knowledge to the team, to complete the puzzle of decision-making, and move on through the various game missions.

S: In some instances I knew a little more than the others on that issue.

R: Bravo, yes!

S: So I drove the others. But on several other occasions the other team members knew more, so in general this is how we moved through the game.

R: And were you open to listen to each other?

S: Yes! We enjoyed and wanted to take the time to work together and learn!

R: Right!

S: Yes, we wanted to complete the missions, but we didn't say to each other that any idea was stupid or that the other didn't know what he/she was saying!

R: That was very good!

S: Yes, we would just lose our time if we criticized each other all the time!

(Int., T4, NM, 210316)

Based on Nico's statement above, students seemed to comprehend the importance of collaboration and efficient communication in order to develop their knowledge as they successfully progressed in the game. Overall, students found the collaborative mode of learning motivational and supportive in the development of knowledge, and for their relations with teammates.

> R: How did you communicate in your team?
>
> S: We had very good communication! We didn't all know each other in the team, but we developed relations in the game and had a lot of fun playing and learning! (Int., T5, DA, 210316)

Negotiated play and learning appears to offer a lot of educational benefits, especially as described by the students above. Obviously, this is a pedagogical approach, linked with principles of social constructivism, and needs to be considered by all education practitioners and decision makers. As the data analysis revealed, teamwork motivated students to remain engaged in the game play, it supported the buildup of their content understanding through peer learning, and developed their interpersonal relations. All these factors can be viewed as an added value to an educational initiative.

Collaborative play in education can evolve as a needs-based learning, where knowledge buildup can be self-customized within a team, according to the students/members characteristics and expectations

Negotiated play and games in general can promote a more customized type of learning process to students, based on their needs, knowledge, skills, and team dynamics. This framework appears to be more efficient as a learning mode since students feel more comfortable to express their knowledge

gaps, and be supported by their teammates to define their learning pace, and to openly discuss any other relevant issue.

> S: I enjoyed being in conversations with the team! Most of the times it was fun and, we could discuss, as we wanted, issues about sex, drugs, alcohol and see what all of us knew and thought!
>
> R: That's very good!
>
> S: Yeah! We showed each other what we knew about an issue and got the point all together! I don't like teaching for too long, and sometimes it's boring, but in the game, it's a process that continues and is fun! It depends on the way you think! And yes we learned from the arguments of people in the game, and some things I didn't know until I began to understand them. (Int., T5, AA, 280316)

This balance between collaboration, learning and students' self-paced engagement came back to my mind as an image while I was reading my field notes. Students got deeply involved in the game flow, deployed their own arguments and opinions, and tried to overcome game challenges based on their own personal experiences and collaboration. This framework of learning and knowledge development is directly associated with scaffolding and a social constructivist approach in education.

Students collaborate, debate and, sometimes, are persistent in their answers, bringing examples from real-life and personal experiences. They seem excited and devoted to the game, and very passionate in their debates. The screen task here is to identify the risks of losing a value (i.e., health, happiness, money, food, friends, school, and family). So they discuss and take their time, but are always aware that in the end, they have to make a decision

to move on. The next task is about judging characters. Identifying whose fault it is when it comes to an improper act (i.e., a woman is pregnant: who is responsible for this, her boyfriend or herself?). Here, the students get more personal, expressing clearly and freely their opinions, and what they feel is a right character. (ObsNotes, T5, 220216)

Students highly appreciated the freedom they had in this learning process, in how to manage new knowledge, and how this was shared with their teammates. They argued that learning was more effective through games, and they looked forward to continuing the engagement.

> It was fun, time passed quickly, we loved talking in the team and I learned more and better by using the game. It was a great experience! We'll continue playing next week, right? (Obs., T3, 070316)

What becomes apparent in the above statements, observations and notes from the game implementation, is that students enjoyed their involvement in this type of learning process, to which they adjusted their own and the group's learning mode and pace. They argued that negotiated play and the game itself had more of an impact on them than mainstream formal education approaches, and that they spent their time in a more valuable and fun manner, customized to their own styles of learning.

The integration of games in education bridges the contested dichotomy of formal and non-formal educational modes of delivery

The use of games for educational purposes has been associated with the non-formal mode of learning. However, the thoughtful integration of videogames in formal education contexts is considered beneficiary by students, due to the overall freedom of interaction which it offers. Nevertheless, it

remains challenging for the instructional designers and teachers to align it with the existing curricula. This generates an overlap between the two modes of delivery, where stakeholders need to consider the instructional design face.

For students themselves this overlap appears to be positive, and effective in their learning process, especially if they focus on non-formal aspects of game implementation.

> The main things I learned through the game is that I have to be careful and that there are things we don't learn in our school courses. For example, about sex and how we can have sex and be protected, how to avoid getting infected and what diseases exist. These are things we don't learn every day. (Int., T4, CP, 280316)

Although there are courses in the school and formal curriculum that refer to Sexually Transmitted Diseases, issues directly related to the act of sex and its potential impact are taught better with the use of a game, like *PlayForward: Elm City Stories*. In this implementation we distinguish the constructive overlap between formal and non-formal mode of delivery. I consider this a vital advantage of videogame integration in formal education, as sketched in detail by Nicolas.

> S: Ok, a guy from the Ministry came and talked to us, not much, but ok.
>
> R: So what you know are your own ideas and thinking? Did you read or hear something?
>
> S: And in biology class we discussed HIV, and the last year we implemented something like a project, as part of the formal curriculum. I learned something from there, but actually school doesn't offer much knowledge in these issues. For

> example, there should be a sexual education class! I saw a video where in other countries at the age of 3 they're introduced to issues related to sex, what to be careful about, what is dangerous, and how to make love. In our country, this doesn't happen. But this game was very helpful in combining things I knew from before, and I learned many things, especially on HIV and other diseases, and how to avoid pressure. These are issues we confront in our lives. (Int., T4, NM, 210316)

Many students felt that through the game they had the opportunity to deploy some of the knowledge they gained from their formal education classes and combine it with the knowledge they were getting from the game. As they stated, they learned about health issues, and highly valued the collaborative approach as educational and attractive.

> R: How did you find the game and what was your overall experience by playing it?
>
> S: I think this is a very entertaining game and you are taught many things! Ok, maybe some other games are fun too, but with this type of game you learn and play with your friends! We enjoyed this a lot and it helped us develop knowledge on these issues. For example, in school there's no appropriate class to receive this knowledge in this way, although many of us seem to know about health and some are even advanced, this knowledge doesn't come from school! (Int., T2, GI, 230316)

The integration of games in formal education does constitute a challenge for the overall educational system, as it will need to be re-designed to integrate non-formal modes of delivery that may not be compatible with its current pedagogical framework.

R: If I ask you to tell me 3 things you remember from the game, what would those be? What did you learn?

S: The game said some things about drugs and I also remember we learned a lot about diseases.

R: Great! Yes, talk about the things you remember.

S: Ok, about diseases about herpes and things you need to be careful about. The game had many facts about AIDS and, in general, about health. Ok, some people talked to us about this in past.

R: At school?

S: Yes, at school and elsewhere. Ok, at school we had some classes about some of these issues but we didn't learn about them as we did through the game, and by playing and having fun with our friends. Maybe it's difficult to have a class like this. So I learned a lot from this game. (Int., T4, EC, 210316)

Moreover, although the game content referring to issues that are taboo for the Cyprus educational system, such as sex, the game provided the opportunity for students to be more openly and actively engaged in the learning process, through non-formal modes of learning.

Students are reading through the game scenarios.

P1: Yeah!

P3: I will do it now!

P1: It's an opinion. I think it's true!

P2: I think it was false.

P1: No! Not the blowjob!

P2: Blowjob is not sex!

P3: Yes, we tried that and it was the wrong answer!

P2: Right, it was wrong!

P1: Shall I try the other option then?

P3: Yes!

P2: Yeeees! Let's go! (Obs., T4, 100216)

Going through the above interactions of students, we witness the ease with which they discuss between them on issues about sex. I think these discussions would be difficult to take place in a mainstream formal class, and in the presence of a teacher. Therefore, the integration of games in formal education, as a tool of non-formal education, would increase learning efficiency and the active engagement of students in controversial themes, such as sexual education.

Although there are challenges for the integration of games in formal education related with the revision of the overall structure of the curriculum, the necessity for equipment of skills and tools and time management, students seem to highly appreciate this potential. The games provide opportunities for bridging formal and non-formal modes of learning that help students be actively engaged in classes, to discuss controversial issues and build up their knowledge in a more effective and attractive manner.

A primary challenge for the integration of games in formal education is the delay of students comprehension and full involvement in the play mode, due to the learning curve they have to go through

As would probably happen with many other educational technology tools, so in this research, too, it became obvious that students would need some time to become familiar with the play mode of videogames. Games by definition have a play learning curve, which students have to cover at the beginning of their engagement, including the game format, the navigation, the rating system, the comprehension of the narrative, and the mobile device usability.

> R: Did you have any difficulties in playing the game?
>
> S: Hmmm! Basically, in the beginning, we were all trying to touch the screen and play at the same time, and it was difficult to get the correct answer; we were very often going back and forth!
>
> R: Does this relate to the game content?
>
> S: Yes, sometimes, especially during those sessions, I don't remember the names now, where we had to debate with other characters; sometimes, in the beginning, it was confusing about what it was really asking. We thought we knew what we were doing, but in reality we didn't. (Int., T4, CP, 280316)

Students recognized this challenge and their need to have time to understand the way the game functions.

> R: Cool! Tell me how you played the game.

> S: In the beginning we were lost! We knew nothing, but we gradually started to learn. Ok, basically in the beginning we knew nothing, we did have an explanation or a meaning, but we also tried not to understand it too much. But as time passed and the game became more familiar and easier to play, we started getting into the meaning and purpose of the game. (Int., T4, NM, 210316)

However, some students, when becoming too familiar with the game, making it easier to play, they found it boring. Also, contrary to the statement above, they thought that in the beginning it was more interesting and engaging.

> R: Which elements of the game did you find more or less interesting?
>
> S: There are many things in both categories. Ok, when we need to do the same thing all over again and get more stars or when we didn't get the right answer. To be honest, by the end it was very boring because we did it again and again.
>
> R: What did you like about the game?
>
> S: Ok, in the beginning it was harder to move, it was more interesting, you didn't do the same things too many times. We had to solve problems for the first time, but then it was boring. (Int., T3, FD, 280316)

Other than the above exception of students' statements on their progressing familiarity with the game, what we can also conclude is that the effort to comprehend the game, encompasses a skills development process itself. As Fanos states in the quote above, they had to "solve problems for the first time". By accessing the game at the initial sessions of the case study, students had to deploy skills associated with critical thinking, problem solving, flexibility and adaptability. Therefore, we

can argue here that games' value in education is more about the content and narratives, but are also about the way students use them and interact with them.

> R: As you were progressing in the game, what challenges and difficulties did you face?
>
> S: Well, we had some difficulties on some levels where we had to make difficult decisions and find an agreement. But this was mostly in the beginning. We had to do more thinking then, to better understand what to do and how to work together and build our experience to manage our play though the game. This was something we really learned! (Int., T5, DA, 210316)

This buildup and deployment of skills was obvious during the observations of the initial sessions of the game, where students tried to understand the play mode and format, and also how to collaborate with each other. Communication, negotiation, critical thinking, creativeness and collaboration are some skills they developed, as they tried to learn how to play the game.

> P2: No, stay here! We can't take that one!
>
> P1: Let's take it with them and find more clips.
>
> P2: No, we shouldn't do that!
>
> P3: I'm thinking maybe if the window was open we could go in!
>
> P2: Here comes the police!
>
> P1: I will not go back again!

P2: Yes, but this is what it says here and what we have to do!

P3: Can you see here, there are broken glasses!

P2: Come on, move there!

P1: Oh, we need to do this one, too?

P3: Don't know. Shall we get some proofs?

P2: Yes, it seems we should move right to find something else.
(Obs., T5, 150216)

The effort of students at the initial sessions to comprehend the way they should navigate in the game environment, and explain the meaning of the various signs popping up around them, beyond skills, also generated time constrains. This is an additional challenge directly related with the learning curve students need to pass, to start playing the game more efficiently and consciously.

> The participants seemed to have fun playing the game, they really enjoyed it! Moreover, they seemed very careful and a bit reluctant to make move. They actually started to feel more comfortable with the game after a couple of sessions. (ObsNotes., T5, 150216)

The challenge of time management during the initial sessions is also evident as the students navigate through the game environment, where they try to complete the mini-games within the time available.

P3: They are 12! There are too many, we don't have time! Let's go to this one!

P1: Yes, that's the shortest.

P3: 3 minutes!

P2: There's no way to make it in the remaining time!

P1: Which one is that?

P3: No, no! Let's go to the last one! We can make it! (Obs., T2, 22/02/16)

As was analyzed in the section above, one of the major challenges that educators and instructional designers need to consider was designing the integration of games in education, the learning curve students need to pass to be fully engaged. Many students stated that the initial stages of the game were challenging as they were not fully conscious about how and why they were playing the game. Additionally, students had to better manage their time to successfully complete several initial game missions. Nevertheless, some students found these initial challenges more stimulating and engaging than the following sessions of the game, which were boring to them.

Moreover, beyond the above challenges and opportunities created by the learning curve, an important side effect of this challenge is its impact on skills development and deployment. Students have to function in a new virtual environment with unknown play modes and regulations, need to deploy critical thinking, problem solving, creativity, flexibility, and collaboration skills to overcome the lack of familiarity, and understand the game functionalities and purposes.

4.6. Assertion 5: Students' Views on the Use of Games in Education

Students who participated in the case study implementation of the *PlayForward*: *Elm City Stories* mobile videogame developed their own views and perceptions about the usability, effectiveness and impact of games on education. Students argued about the importance of collaborative learning, on the usefulness of games for content knowledge development and skills upgrading. In this context, I have developed Assertion 5, which states: "students positively perceived the use of games in education as

they thought the game supported the development of a variety of skills, empowered content learning and offered alternative modes of interaction with the learning objects". The assertion will be broken down to 3 different sections, referring to skills development, content learning and collaborative learning, and will be discussed based on the views and perceptions of students engaged in the game implementation.

Students perceived that the game supported the development health literacy skills in an educational environment

Health literacy skills development is the primary objective of the *PlayForward: Elm City Stories* videogame. Moreover, the purpose of this research was to identify the efficiency and impact of the games implementation on skills and knowledge development. I was interested in identifying how collaboration, negotiated play and decision-making processes, through games, support the delivery of the outcomes abovementioned. Having argued in previous sections about the importance of thoughtful engagement and conscious skills development of students, it was important to investigate their views and perceptions on this field. In this context, I was initially interested in examining whether students can identify any of their skills being developed through the game. As was apparent from their replies in the post-implementation interviews, they were aware of the range of skills needed to deploy for decision-making processes.

> R: That's very good! So, please reflect on – from the day you started playing this game up to now – all the things you learned, the experiences you had, the major skills you developed?

> P: I certainly learned about collaboration skills by playing in teams, and how to judge the ways my friends think so I can talk to them and communicate. Also, the development of critical thinking skills through the process of how the story progressed was very important, as we had to make decisions based on what we next expected to happen and what the future of our characters would be. So, all this really taught me a lot of skills! (Int., T5, DA, 210316)

With students having in mind skills attached to decision-making processes, it was important to examine if the skills development was linked with the game. According to students, some of their health literacy skills had developed.

> S: Yes, this game is very important for health issues!
>
> R: So did you develop any skills by playing the game? I mean not only as content but also from the way you played the game, where you all had to decide how to move?
>
> S: Yes, sure! I learned how to communicate with others because we all had to do something together in the game! It wasn't just what I wanted and just my decision. We had to collaborate and think as a team, to understand and discuss all opinions and not just impose what I thought! (Int., T4, CP, 280316)

So it seems that students, through their participation in a group, and through a collaborative approach developed some skills. Students thought that the overall implementation mode, based on teamwork and using the particular game, improved their decision- making capacity.

> S: Yes, we change roles in the game, depending on what each of us thought and how we could all work together to make a decision. Initially, we had to learn how the game works and then support each other to make decisions. It was the only way for the game to move on; we had to collaborate, communicate and think together, there were questions that we needed to think about many times before taking a decision. We made mistakes in our choices, and in the next round we had to acquire a better judgment on what to decide, and how to complete the mission. (Int., T1, EC, 210314)

It is a very interesting outcome for the case study implementation, to motivate students to build such a positive perception on the game's impact on skills, associated with the decision- making process, in the broader context of health literacy. Also, with students, knowing the concept of decision-making, they were consciously engaged in such a process and also deployed a metacognitive reflection on their actions.

Students perceived that they acquired content knowledge related to health literacy through their participation in this game case study implementation

Beyond skills development, the game also offered some data and facts related to health issues and quality of life. Another interesting point to bring up from the data analysis is the process where students combined hard core knowledge and skills development. This claim became apparent at the post-session statements of students (one representative per team was making a short reflection on the day's game play session), as shows the one below from Team 4.

> S: What did we learn today, eh? Well, we worked together and collaborated in game play and we learned about STDs (Sexual Transmitted Diseases), and that herpes is not curable. This is something we discussed a lot between us! Also, that HIV contraction is for life! In any case, I will google to find out if herpes is uncurable because I still don't believe it! (Obs., T4, 020316)

Christiana's statement demonstrates that at least within her group, the game achieved its aim, and provided knowledge on health issues, and developed some aspects of health literacy skills. With regards to knowledge and information about health issues, students seemed to acquire important information and understanding, related to the overall game themes. Beyond the game itself, an important aspect of knowledge development has also been the interaction between teammates. We witnessed controversial health issues lead students to further negotiations and collaboration, deploying, at the same time, critical thinking and problem solving skills (i.e., searching google for validation). Additionally, it is safe to claim that students in their efforts to take informed decisions as members of a team, were motivated to develop their content knowledge.

> S: It was a great experience because we learned many things about health issues I had never heard of before! Like hepatitis or how you get HIV or herpes. I also learned about pregnancy and sexually transmitted diseases! It was great because we learned all this, and communicated and discussed it in the game; this way, we could choose the right answer in the mini-games. I really enjoyed and learned important things about life! (Int., T4, NM, 210316)

It is also interesting to see how students valued the content knowledge they received from the game and how they contextualized it to fit with their own real-life experiences. Also, it was positive to

observe their enthusiasm, as they interacted and comprehended new learning objects throughout their game play.

> R: So, did you learn something from the game that would probably be relevant to real-life experience?
>
> S: To be honest, in the beginning I thought there was nothing to learn from this game and that I knew all the issues it was talking about! But after a while I realized that there were many things I could learn from this game which I didn't knew before! Ok, I knew that you shouldn't have sex without using a condom, but learning about HIV and hepatitis was also very important.

The sense students had, that as they proceeded through the game they would gain new valuable knowledge, seemed to maximize the attractiveness of the game and the motivation of students to play.

> Continuing to play the game with enthusiasm and discussion! Overall, the students seemed to enjoy the game as they learned about peer pressure, HIV and the effects of drug use. (ObsNotes, T1, 290216)

The vast majority of students did share this enthusiasm of interaction with new learning objects and knowledge, and many of them emphasized the importance of issues related to sexual education.

> Yes, I learned things I didn't know before! From what I remember you can get herpes from kissing because there was one particular character, and I think he was drunk, who was trying to kiss someone who had something on her lips, and from what we learned he was infected by kissing.

(Int. T2, GI, 230316)

However, there were also deviations to this opinion, as can be seen in the student's quote below, who stated that, although he learnt new things, he found the learning topics not appropriate for the age of his classmates.

> I think we learned a lot but it would work better for older people. I don't think these chapters are for us or teens. Maybe it would be better if we had some degree of sexual education before, but it would be better for young/older? people, but not for us. (Int., T1, SS, 280316)

Stavros argued that the content was not appropriate for their age group, mainly because they do not have the educational background to receive this kind of information. This statement is significant for the Cyprus context, as sexual education is absent from the formal education system. Also, it's a statement to be taken into consideration at the phases of game content design, as the content has to be adapted to its implementation ecosystem. Nevertheless, the majority of students remained positive towards the game's content knowledge on health literacy and sexual education.

> R: Are the things you learned from the game useful to you?
>
> R: Yes, definitely! Issues on sex, drugs, or how to make friends are what we have to deal with outside the game, in our everyday lives. There were many things that I learned from this game that are very useful to me. (Int., T2, GI, 230316)

A game that provides the grounds for content transferability to real-life contexts, constitutes a great advantage and increases its educational value.

Summing up this sub-assertion, students believed that they acquire content knowledge related to health literacy through this game implementation. However, one student thought that the game's themes related to sexual education were out of their own context and background. I found this to be a valid argument, having in mind the absence of sex education in Cyprus' schools. Nonetheless, the vast majority of participants appreciated the content knowledge development, and the understanding they developed on how to use this knowledge in real-life situations.

Students positively perceived the collaborative learning process, designed for this game implementation case study

When changing an established learning mode, students are challenged to adapt to the new approach and pedagogies, as well as to learn how to interact with knowledge in new learning environments. To be specific, the challenge for students was not the collaborative mode of learning, as they are familiar with it, but negotiated play with the use of a mobile videogame. For this reason, one element that I was interested in investigating was how students themselves experienced their learning process through this collaborative and negotiated play approach, with the use of this specific game.

A great number of students, as indirectly discussed in previous assertions, ranked the opportunity they had to learn from each other positively, while, at once playing and having fun.

> R: Tell us more about your work with the team! How important was it to play a game as a team, and how did you experience the learning process?
>
> S: By playing the game in a team it was very interesting to see what other members of the team thought and knew about issues of sexual education, alcohol and drugs! I think it was a very good process on how to learn from each other, and to make

> friends! We learned much more about some themes, and, at the same time, we were playing a game and having fun! (Int., T5, AD, 210316)

An important aspect of collaborative mode and play, emphasized by students, is that they were consciously engaged in the process to negotiate opinions, characters and views, both within the game scenario, but also as a part of the team decision-making actions. On many occasions, students indicated this skill development as useful and beneficial for them, associating it also with case study design.

> Of course, in the way that we played, I had to look for the positive points of my teammates, and then I could learn what is right and wrong! It's very important to see others' opinions so as to learn and understand what's going on in the game. And as we moved on, we found more common ground to talk through, to teach each other and try to change wrong opinions. (Int., T1, SS, 280316)

Assessing a personality and negotiating views, actions and opinions was also an integral part of the game. Students, according to my field notes based on observation, were excited to collaborate and negotiate on how the game character would evolve and take decisions.

> Students are collaborating, debating and have a team spirit throughout the game. They seem excited and devoted to the game. The screen task is about preventing a character from becoming drunk (they have to mention reasons why not to become drunk) and then to indicate the occupation that their character might want to have in the future setting their own criteria (salary-based criterion, morality-based criterion). (ObsNotes, T5, 220216)

The themes of the game, referring to drug and alcohol abuse, were never taught in the formal education system of Cyprus, and students felt that through collaborative and negotiated play, they could learn about these themes in an easier way. Students' perception that through peer learning they can learn better about new topics, is an interesting outcome of the research. As Christina noted in the post-implementation interview, she would take longer, if played alone, to finish the game, as she was not aware of the game's themes. Through collaboration and peer-to- peer support, along with her team progressed more effectively in the game's narrative and missions.

> R: Did you like the game? Would you prefer to play it on your own?
>
> S: I, personally, didn't know many things about these things, but others knew so…
>
> R: So it would be a different experience if you played the game alone?
>
> S: I wouldn't have finished it in 4 weeks, but in 3 months! Because nobody taught me these things, I wouldn't know what to do at every step, but with the knowledge of others we could move in the game. That was one of the positive elements of the game! (Int., T4, CP, 280316)

The implementation of the game in a collaborative and negotiated play process, motivated students to express and debate opinions in a learning mode and enjoyable context, including thematic knowledge acquisition and health literacy skills development.

> R: How did you experience the game play in a team?
>
> S: Playing with friends is always more fun! I really liked the game because we could talk, see each other, and exchange opinions and views! I don't think I could

> play this game alone, because sometimes it's hard, you don't know everything and it may get boring. But with friends we help each other, we learn about important health issues, and it's a new experience. (Int., T5, DA, 210316)

Students, who participated in the game implementation, highly appreciated the play mode, focused on collaborative learning, as they perceived this approach to be efficient and attractive in acquiring new knowledge. Interaction, views negotiation, and decision-making, as part of team work, appeared to be engaging and motivational. Peer-to-peer learning seems to be a central outcome of collaborative and negotiated play, where students felt they gained knowledge and skills from each other.

5. Discussion of data analysis and results

5.1. Introduction

Mobile technology and associated devices are gradually becoming a widely used medium of learning at all levels and types of education, from formal to non-formal settings, and from schools to enterprises (Park, 2011). While mobile learning started to evolve at the beginning of the millennia (Keegan, 2002), it is only recently with the popularity of smartphones and tablets, that mobile videogames are gaining popularity in education (Shin, Norris, & Soloway, 2011). Part of an educational context, mobile videogames are expected to provide multiple pedagogical paths for learning, directly connected with the principles of social constructivism, including ongoing interaction, skills and cognition-oriented learning, as well as motivation for ongoing engagement (Bo Xie, 2011; Komalasari, 2009). Nevertheless, there are still limited good practices of implementation, and limited assessment techniques of mobile videogames impact and value (O'Neil, Wainess, & Baker, 2005). Additionally, education and training practitioners, such as teachers, trainers,

instructional designers, decision makers, principals and directors, lack both the theoretical and applied framework of the integration of mobile videogames in education (Park, 2011).

My primary objective in designing and implementing this case study, initially, was to investigate the pedagogical value, and the impact and learning outcomes of the implementation of the *PlayForward: The Elm Street Stories* mobile videogame in a non-formal context. A later objective was also to sketch the process of the implementation, data collection and analysis in a manner where other interested researchers would be able to identify opportunities, challenges and gaps relevant to their own context.

Overall, the massive attractiveness of mobile videogames among students (Kiger, Herro & Prunty, 2012), demands the investigation of their educational value, their impact on knowledge and skills development, as well their potential multiple delivery modes (Chen, Wang, & Lin, 2015). Following the outcomes of the present case study, the examination of mobile videogames' learning potential should also be extended to examine collaborative and negotiated play. The emphasis on collaboration is heavily linked with the development of decision-making skills, which constitute an integral part of health literacy (Xie, 2011).

The overarching purpose of the present research was to investigate how mobile videogames promoted health literacy related skills, what the educational challenges are, opportunities that emerge from the use of mobile videogame, views of students, and what affordances a mobile education videogame should carry. The mobile videogame *PlayForward: Elm City Stories* provided the opportunity to design and implement a negotiated play case study with groups of students, directly associated with social constructivist pedagogical modes, from which valuable data were collected and analyzed.

In the present chapter, I reflect on the data analysis and discuss the outcomes of the research, linking, validating and adjusting them to the current literature of mobile videogames in education, decision-making and health literacy. The discussion is based on the data coding's major categories and assertions, which refer to game affordances, decision-making, social trajectories, educational challenges, opportunities, and students' views. Through this discussion, I also try to provide justifiable and comprehensive answers to the research questions that guided the overall case study implementation.

5.2. Game Affordances

From the data analysis, it became apparent that valuable educational affordances of games were associated with technical aspects, the provision of collaborative play opportunities, and real-life connections of the games' narrative. The assertion related to affordances was framed and validated as follows: "The affordances of the game, such as the variety of play modes, the technical aspects of the game (sound, usability, rating system, and visuals), the support for collaborative play, the game narrative connections to real-life contexts, and the potentials for skills development, guided the learning game-play experience of the students". In this research, the meaning of the term affordance is borrowed from the explanation provided by Vrasidas and Solomou, who built on Gibson's work (1977 & 1979), and describe it as the features of an entity or object which define its usage and interaction in multiple processes and ecosystems (Vrasidas & Solomou, 2013).

As students noted, the game, during its initial stages, was more attractive and supported their ongoing engagement in the play and learning process, as students were playing the various missions in multiple modes. On the other hand, when a game becomes repetitive, and is not challenging enough, it becomes boring and students' engagement becomes mechanical. On many occasions, the

Elm Street Stories videogame raised questions from students, like why not just access the internet to learn about health issues. Therefore, as previous research demonstrated, educational games are valuable learning tools, as long as they consistently challenge students to improve existing or deployed new skills, through the provision of variety of play modes and mission designs (Simões, Redondo, & Vilas, 2013). Practically, games are valuable if they create? a social constructivist framework where students negotiate meanings, scaffold and connect knowledge and skills, interact with the wider ecosystem, and reflect meaningfully on their play actions (Bers, 2008; Hernandez, 2013). During the current game, students found themselves waiting a long time before they interacted with the game as there was continuous conversation between game characters. Ongoing interaction with the game and active engagement of the players in the narrative, are also vital in stimulating their conscious engagement in a learning process (Pivec, Dziabenko, & Schinnerl, 2003). Summing up this section, for an educational game to secure a thoughtful, ongoing engagement in skills and knowledge acquisition, it must provide a variety of interactions with the game ecosystem, different play modes and missions, and multiple ways to reach an objective (Olson, 2010, Squire, 2006; Allen, 2011; Kolb, 2011, Collins & Halverson, 2010).

Technical affordances of a game are an important aspect for securing attractiveness, engagement and consequently, quality learning. Although students did not express much, in their interviews, on these affordances, on some occasions, they did emphasize the importance of visuals, sounds and usability for their overall play experience. Any game's technical affordances, including functionality and usability, should be taken into consideration at the design phase, as those will be real paths for reaching the learning objectives (Koole, 2009; Naismith al., 2004; Strack, Magill & McDonagh, 2004). Therefore, game developers must be fully aware of the digital literacy levels of

their target groups and their familiarity with mobile devices and games. Furthermore, for game developers, teachers and instructional designers, the alignment of visuals and sounds within the overall pedagogical framework and game theme, increases the gaming experience and authenticity, which will reflect on students' thoughtful engagement (Arnab et al., 2013; Ke, 2009).

An important characteristic of the game that was identified by students, as extremely supportive for their engagement in the play process, was the provision of instructions and feedback on how to play and move in certain missions. The availability of such a feature supports students' comprehension of game functionalities and empowers their conscious play process (Simões, Redondo, & Vilas, 2013).

Another attractive feature of games that motivates students' conscious and ongoing engagement is the scoring and rating system. Through this feature, students are able to assess their progress through the game's missions, associated with skills and knowledge development. Moreover, the rating system of the *PlayForward: Elm Street Stories* game supported the development of students' strategy and critical thinking skills, as observed during the case study implementation. A scoring process linked with students' progress in the game helps them to reflect on their engagement and improve their metacognition capacity (Whitton, & Hollins, 2008). Moreover, by scoring points, students develop a sense of control over the game process, as they can plan their next moves, giving meaning to their game play (McCallum, 2012; Ke, 2009).

A vital element of the game has been its narrative, and how that is relevant to the real-life of students and the experiences they had. The attachment of gamers with the narrative and characters, improves the educational value of the game, as they comprehend and appreciate their involvement in this learning process (Flyvbjerg, 2006; Pivec, Dziabenko, & Schinnerl, 2003). Also, the narrative of

the game, and the potentials it offers for real-life contexualization, encompasses the development of a series of skills (Bofill 2013; Schunk, 2011; Linehan et al., 2009). As students stated in their interviews, they developed the capacity to visualize themselves as parts of the game plot, triggering their imagination and critical thinking, and their ability to contextualize new knowledge. Nevertheless, some students found parts of the game to be boring, in which the story was moving in a very slow pace and without excitement. It is always a challenge to develop a story for an educational game, which will be attractive throughout the play. Therefore, game designers should consider different forms of a continuous interaction of students with the game missions and progress, to bypass this challenge (Kearney, Schuck, Burden, & Aubusson, 2012).

One of the central elements this case study implementation addresses in all data sources and later, in the analysis, is the affordance of the game to support a negotiated play mode and motivate discussions and decision-making processes. Moreover, this was a feature greatly appreciated by students, who believe that it contributed to their thoughtful engagement and learning. Specifically, students found the mini-games design and challenges to be motivational for negotiations and collaboration. Collaborative and negotiated play was also supported by the game narrative, which addressed controversial health issues, reflecting on different opinions and experiences of students. In this context, students were led to discussions, negotiations and peer support. Many students expressed their preference to play games in a collaborative mode so they could interact with their friends, learn from each other, and be motivated for ongoing engagement. In this context, teachers who integrate mobile videogames in their lesson plans need to consider the attractiveness of collaboration, communication and peer learning among students (Kiger, Herro & Prunty, 2012). Also, collaborative play is considered by many researchers to be an effective learning process itself, central to the

instructional design of any course (Sins, van Joolingen, Savelsbergh, & van Hout-Wolters, 2008). Additionally, as will be discussed in other sections, collaborative and negotiated play and, to a greater extent? learning, fully supports the development of skills related to health literacy, such as networking, communication, collaboration, critical thinking, leadership, and decision-making (Arnab et al., 2013). Consequently, the affordance of a mobile videogame to support collaboration among students is an important indicator of its efficiency and value to promote learning and skills development (Bo Xie, 2011; Whitton, & Hollins, 2008). Finally, the combination of collaboration, negotiation, creativity, contextualization and critical thinking, through a mobile videogame, can give meaning and understanding to complex issues, such as health literacy (Hieftje, Duncan, & Fiellin, 2014).

5.3. Games and Decision-Making

The 2nd assertion argues that "students believed that their participation in the *PlayForward: Elm City Stories* mobile videogame implementation case study, facilitated their engagement in decision-making, and developed their communication and critical thinking skills in a conscious and comprehensive manner, however, in reality their participation in decision-making didn't illustrate the negotiations of ideas". The engagement of students in decision-making through their participation in a negotiated play case study, has been the second part of the second research question.

In my research, I was very interested to investigate how students understand the decision-making process as part of their overall engagement in the game, and how relevant skills were developed. Students emphasized the importance of freely expressing their opinions within their groups, and discussing their views on complex health issues. In a decision-making process, the volunteer engagement is vital, in order for all participants to be receptive to other opinions, willing to

learn, and be prepared to reach a consensus (McBride & Xiang, 2003). These premises are important for designing an educational environment, which would support decision-making. Students themselves argued that through discussions, they developed respect towards diffident opinions, and on many occasions, were listening and learning from their teammates.

Students stated that the game design and narrative, motivated them to work with each other, to argue and promote their opinions, and eventually take a group decision. Not all games promote the collaborative and negotiated play and decision-making process; however, *PlayForward*: *Elm Street Stories* was successful in doing so, although it was not designed to do so. Students also highly ranked the various game themes related to health literacy, as in various game stages that were associated with different students. Apparently, if the learning objective is to develop the decision-making skills of students, then a hospitable learning environment, such as games, should be identified and integrated in the lesson plans (Whitton, & Hollins, 2008; Linehan et al., 2009). A game can be designed to resemble real-life conditions, which makes the collaborative decision-making process easier, and more efficient in building up relevant skills (Linehan et al., 2009). This approach fits perfectly when the educational game's aim is to advance health literacy skills connected to problem solving, strategizing, networking, negotiating and visualizing (Raphael et al., 2010). From the data analysis, it seems that the design of the game missions was, also, a critical element for promoting collaborative decision-making. Students stated that they found the mini-games of each mission to be the most appropriate environments in which to discuss, express their opinions, and enter decision-making processes. Research in game design has emphasized the importance of short tasks and small missions to facilitate ongoing negotiations, collaboration and engagement of students, since these tasks are visible and the impact of successful completion would be immediate (Whitton, 2011; Dickey, 2006).

Moreover, the development of such skills through a relevant mobile videogame, would be more efficient since its attractiveness, popularity and flexibility would motivate a conscious engagement of students in the decision-making process (Linehan et al., 2009).

Nevertheless, the implementation of collaborative and negotiated play initiatives that motived students to engage in decision-making are not successful by nature. In the present case study, some students found a series of limitations, such as friction among students, the long duration of some negotiations and discussions, and the conscious disengagement of some students. As previous researchers have argued, it is important that such implementations be applied within the presence of a facilitator, who could address such challenges on the spot. The facilitator could provide support in terms of content understanding, speed up some decisions, motivate the engagement of all students, and manage whenever appropriate, any friction created within the groups (McBride & Xiang, 2004; Ke, 2009).

The engagement of students in collaborative and negotiated play, and by extension, in decision-making, attached students' actions to real-life experiences. Moreover, students seemed to comprehend how the game and its educational affordances, let them develop their decision-making skills. Decision-making is part of our everyday life, and is a process to be learned by using the appropriate medium and pedagogical practices (Smith, 1998). The skills associated with decision-making are linked to health literacy, such as critical thinking, visualization, negotiation, leadership, and networking. Any educational initiative is expected to facilitate the development of the above skills (Baysal, 2009; Hernandez, 2013; Powell, & Kalina, 2009).

In game design, the selection and buildup of an avatar's features, is considered to be an effective educational process of self-negotiation, real-life contextualization and visioning (Dickey,

2006). As I noted, students seemed enthusiastic and engaged while they were negotiating the development of their game character. Also, during game play they were reflecting on their expectations and experiences related to the attributes attached to that character, bringing examples from real-life. The sketching of an avatar attaches to the game, elements of authenticity, contextualization, and supports a creative and ongoing motivation for engagement, as students become attached to their game character (Kearney et al., 2012; Olson, 2010). The development of a game character in this collaborative and negotiated mode, proved to be a skills development process. Particularly, for an educational game targeting health literacy, the opportunity for students to develop their own character is associated with the learning objectives of the game (Naismith al., 2004). Students feel like they are experiencing the life of their avatar, and they need to collaborate to take important decisions, which are related to health and well-being issues (Fuchslocher et al., 2011).

The complexity of some mini-games, and the variety of health issues led students to multiple paths of the decision-making process, including voting, consensus, or an exchange of final decisions between them. Moreover, students appeared to realize that every decision in the game affected the progress of their teams. Therefore, many students referred to the sense of responsibility they developed being part of a team. This consciousness was apparent both in the implementation observations and their registered discussions, as well as in their post-implementation interviews. This development of students' cognition and practices to reach an effective method of decision- making are characteristics of effective educational games (Robertson & Howells, 2008). Such games constantly challenge the skills of students and their ability to adapt, to solve problems, to create and collaborate (McFarlane, Sparrowhawk, & Heald, 2002). This was the case of the *PlayForward* game, which provided a decent range of decision-making and opportunities of trial and error. These types

of games motivate students to actively, and critically engage in knowledge and capacity building practices (Gee, 2003).

Students felt they had been engaged in decision-making processes in a thoughtful and comprehensive manner. In many instances of students' lives, they had to make a decision, however, they never thought about the process itself, or the necessary skills attached to it. Through participation in the game they noticed how some of their skills improved, especially those related to critical thinking, collaboration and negotiation. Researchers have demonstrated how the development of such skills occurs effectively in educational ecosystems characterized by real-life stimulations, where students express their opinions freely, negotiate, collaborate (Raphael et al., 2010).

Many students replied positively about whether they actually felt a series of skills being developed throughout the game case study implementation. Such results were also observed in other similar studies based on collaborative and negotiated play, where students identified leadership, critical thinking communication, negotiation, planning and collaboration skills to evolve (Olson, 2010). In order for students to be able to reflect on their skills development, they need to acquire ownership of their decisions, and have a direct influence on the pace of learning (Baysal, 2009), something that was provided in this case study implementation.

Despite the enthusiastic reflections of students from the case study experiences, in reality their practices didn't illustrate much negotiation of ideas. What I am arguing here is that students were negotiating for potential answers to the game challenges by deploying relevant skills, without any content-oriented argumentation. Of course, this statement doesn't imply the absence of skills development through a decision-making process, but it does imply the limited contextualization of the process. The game, in terms of content, did provide opportunities for discussions around health

issues, perceptions and ideas (sex, drugs, alcohol). Nevertheless, as the game evolved with some repetition of its challenges, many decisions were taken mechanically.

As the data analysis revealed, this was caused for two reasons. Firstly, the game design didn't provided opportunities for immediate research and open-ended questions, where students would have deployed content related knowledge, or negotiated an idea or perception they had (Linehan et al., 2009). This is a typical shortfall of educational games, as they need more sophisticated programming and design to manage open-ended missions. Such a challenge can be met by combining the game play with activities outside the game, such as inter-group discussions or further research on game themes (Whitton, & Hollins, 2008).

The second reason has to do with the game narrative and content. For students to be engaged in high quality decision-making processes, deploy skills, knowledge and ideas, they need to have a basic understanding of the content (Nicolaou et al., 2009). In this way, they will be able to discuss "about causes and effects, advantages and disadvantages, and alternative outcomes to the decision-making process" (Nicolaou et al., 2009). However, as I discussed in the data analysis chapter, the vast majority of students had limited content knowledge or background on issues related to sexual and health education, as these are absent from the Cyprus formal education (Ioannou et al., 2014). Overall, studies show that young students avoid using content related argumentation, or mistreat useful information in the decision-making process, making the whole process less efficient and educational. As has been argued by others, universally, students have never been taught how to effectively negotiate, take autonomous decisions and collaboratively solve problems (Linehan et al., 2009; Sadler & Donnelly, 2006). Decision-making is a vital skill for our lives, whereby, at every moment, we need to choose the best option through an informed process. This process requires an authentic and

intended capacity building of skills, such as creativity, negotiation, critical thinking, and communication (Baysal, 2009).

5.4. Social Trajectories in Negotiated Play

One of the most interesting areas to investigate in this research study was the development of social trajectories among students, through negotiated and collaborative play. "Negotiated and collaborative play in teams, shaped social gaming trajectories, such as students' inter-personal relations, self-reflections on students' own life experiences, and discussions beyond the game themes." This was the 3rd assertion of my research.

The case study design and implementation, based on collaborative learning and negotiated play, proved to be a fertile ground for new friendships, and students' interpersonal relations. As students described, their constant interaction, collaboration and negotiations brought them closer. Beyond the overall implementation design, another critical factor that developed the interpersonal relations among the participants was the theme of the game. In many instances, students opened up to each other on issues of health and well-being. Moreover, as noted in previous sections, this case study implementation was the cause for the establishment of a game club at the hosting school. Therefore, the volunteers and participants in the case study shared a common interest and a hobby, which as they said, through it, they expected to build up their relations and friendship. Other studies also emphasize the appearance of such social trajectories among game players who collaborate face-to-face or remotely (Olson, 2010). This indirect outcome is also considered a motivational aspect of collaborative learning approaches, by which volunteers are engaged to make new friends, or become members to a group (Przybylski, Rigby & Ryan, 2010). Moreover, some researchers consider the

development of friendships and networks to be as significant as the educational process, since it encloses the deployment of a variety of skills (Xie, 2011).

The negotiated play generated and supported students' reflections on their life experiences, also related with the game content. Obviously, on many occasions, students were attached to the game's themes and characters, as various missions resemble parts of their real-life experiences. In this context, students discussed with each other in a self-reflective mode, loudly expressing their thoughts and opinions about drugs, sex and well-being. Additionally, the missions led students to acquire the roles of game characters, and reflect on how those characters would react in real-life conditions. This process helped students imagine their future, and how they would see their personal life in a few years ahead. An interesting aspect of this self-reflection process within groups was the actual interaction with game characters, as if they were real persons. This phenomenon of self-reflection on students' real-life experiences and expectations was triggered by the game content, and, as the students argued, they found discussions on personal issues to be educative and beneficial.

Although students indicated that entering a self-reflective mode was attractive, motivational and educational, in a formal education environment there are very few opportunities to do so (Ioannou et al., 2014). Therefore, self-reflection on the interconnections between learning objects and real-life should be an essential part of any learning process in order to maximize its impact and value (Yoders, 2014; Whitton, & Hollins, 2008). Educators and instructional designers need to integrate in their lesson plans, collaborative and negotiated play approaches to learning, which would trigger participants' self-reflection, and contribute to a higher understanding of learning objectives (Kiger, Herro & Prunty, 2012).

As was expected, students working in groups had the opportunity to discuss and learn about issues not directly related to game themes. While some may consider this a gap in the overall implementation, research suggests the contrary. This side-effect in the case study resembles what is actually happening in life, where people share information, jumping from one issue to another, empowering the overall learning process (Pivec, Dziabenko, & Schinnerl, 2003).

Students had the opportunity to discuss other games, new technologies, and movies with their teammates. This flexibility of discussion and interaction is attractive and beneficial for students, as they are motivated to be engaged in more collaborative learning activities, including negotiated game play (Miller et al., 2013; Xie, 2011). Therefore, when practitioners are designing such an implementation, targeting the development of health literacy skills, students must be free to interact and discuss, as they would do in the real world. This type of authenticity of communication and negotiation between them will support the contextualization and transferability in real-life, of skills and knowledge gained through collaborative and negotiated play (Pasek et al., 2008; Raphael et al., 2010).

5.5. Challenges and Opportunities of Integrating Games in Education

The integration of games in education generates a series of challenges and opportunities that practitioners need to take in consideration. As the 4th assertion states, “integration of games in education and health literacy initiatives, generates as series of opportunities and challenges, such as the attractiveness of the collaborative play and learning, the promotion of a customized/needs-oriented learning, the bridging of formal and non-formal education modes, and the appearance of a learning curve, which students need to go through to become familiar with the game”.

A most common reply of students in their interviews, on what they mostly liked from their participation in this implementation, was the collaborative play approach. This format of play motivated students to remain committed and engaged in the overall learning process. Moreover, it was an element that supported knowledge sharing among them. Additionally, as students proceeded through the game in a collaborative mode, they stated that they greatly valued the interaction and communication in solving problems and supporting each other. Students also stated that collaborative and negotiated play supported them in content understanding, skills development and ongoing participation, elements which are vital for any educational initiative to be successful (Looi et al., 2010).

Collaborative learning is central in developing health literacy skills, as its progress relies on social interaction and skills development (Xie, 2011; Baysal, 2009). Particularly, this mode of learning along with the use of mobile videogames as mediums of engagement and interaction, has been proven to be highly effective for students (Xie, 2011; Naismith al., 2004). Through collaboration and negotiation students learn to reflect in a more critical and effective manner, both on themselves and the ecosystem around them (Kiger, Herro & Prunty, 2012). Negotiated play has been found to be a social behavior changing activity (Xie, 2011; Naismith al., 2004). In this context, the use of mobile technology, and particularly, games, enriches the overall learning experiences and skills development in an inclusive mode (Looi et al., 2010; Chen, Wang, & Lin, 2015). Teamwork and collaboration are also critical when educators want to introduce new technologies in their classes. As prior research has demonstrated, peer-to-peer support in technology usage is an efficient medium to secure the attraction and engagement of students (Attewell, 2005). Collaborative and negotiated play provides the ground for students to develop a better understanding of the content themes, develop a series of skills and

have an ongoing participation in the learning process (Kiger, Herro & Prunty,2012; Whitton, & Hollins, 2008).

Another opportunity provided by the introduction of collaborative and negotiated play in education is the needs-oriented learning, where knowledge buildup can be self-customized within a team, according to the students'/members' characteristics and expectations. Students were free, within their teams, to interact, negotiate and learn, based on their own pace and mode of collaboration. Furthermore, as bonds among team members were growing stronger, students openly expressed their knowledge gaps in some health issues, and teammates tried to provide support or share any relevant knowledge they had. This kind of interaction became more apparent in the completion of all observations. It was noticeable that their relations within the teams were evolving, as they tried to adjust their progress in the game, based on each member's capabilities and dynamic. Students claimed that this mode of implementation was highly beneficial for knowledge and skills development, as they learn to manage information coming both from the game and their teammates. Students also argued that the control they had over their involvement in the game and in the various mini-games had positive results on their capacity building.

It becomes apparent how the voluntary engagement of students is essential to achieving the learning objectives of any educational initiative (McCallum, 2012; Lankshear & Knobel, 2011). Negotiated play and mobile videogames are fully compatible with the desires and expectations of students concerning how they imagine education, as well as with their day-to-day activities (Ray et al., 2013). In this context, by using mobile videogames, educators are practically customizing the learning process to their students' needs (Kiger, Herro & Prunty, 2012; Simões, Redondo, & Vilas, 2013). Needs-oriented and collaborative learning has been valued as effective for many years now

(Grabinger, Dunlap, & Duffield 1997). By integrating mobile videogames to this approach, it maximizes its potential for thoughtful engagement, self-reflection, content comprehension, adjusted learning pace, communication, peer-to-peer support, and problem solving, among students (Whitton, & Hollins, 2008). Moreover, negotiated play and mobile videogames provide students a contextualization of knowledge, making it easier for them to attach it to their own needs, experiences and expectations (Kearney et al., 2012; Nicolaou et al., 2009). Building on the above argument, games provide a secure environment for young students to experiment, test, and challenge their views, opinions and learning on controversial issues, such as sexual education and health literacy (Olson, 2010).

The integration of games in education builds a bridge between formal and non-formal educational modes of delivery. Such an outcome is beneficial for students, and challenging for educators, who need to revise their lesson plans and curriculum (Looi et al., 2010). What has been positive for students, as they stated, is that they learned about themes which are not part of their formal school curriculum, and which they usually learn in non-formal settings. Such issues include cautious sex practices, avoidance of drugs and alcohol, and well-being practices. The case study participants also praised the design and implementation of a non-formal learning process in a formal environment, such as the classroom. The opportunity to play a mobile videogame, acquire knowledge at their own pace, freedom of interaction and collaboration among them, are considered highly attractive for students' engagement in learning. This liberty, beyond time limits, offered to students has been linked to the development of a high cognition of learning objects, self-reflection of students' participation in negotiations, critical thinking and communication (Looi et al., 2010). Although there is a gap in research results on the impact of mobile technology in learning, it can be argued that the

affordances of mobile devices and mobile videogames bridge the non-formal and formal world of learning. Specifically, the extensive use of such devices and software by students can bring non-formality into the formal settings of the schools, resulting in a direct and thoughtful engagement of students in the learning process (Looi et al., 2010).

Nevertheless, the bridging between non-formal and formal modes of education can be extremely challenging for the instructional designers and educators, as they will probably need a specialized capacity building and revision of their pedagogical practices (Looi et al., 2010). For the case of Cyprus, the introduction of learning objects related to sex education, drugs and alcohol, which are associated with non-formal learning settings would require a cultural and political shift within the formal education system (Ioannou et al., 2014).

A major challenge for the integration of games in education is the learning curve students must cover in order to comprehend the game play requirements. Although, all students who participated in the case study were familiar with mobile videogames, many of them argued that they needed some time before fully comprehending the game format. However, some students stated that the game was more interesting when they were trying to figure out how to play, as it later became repetitive and boring. As students also argued, an investigation of the game's functionality and usability during the initial sessions, empowered the development of skills, such as problem solving, creativity, flexibility and critical thinking (Naismith al., 2004). The positive impact of this challenge is that the attractive unknown of the mobile videogame ecosystem, generated curiosity and maximized the engagement of students (Kiger, Herro & Prunty, 2012). Nevertheless, some students believed that the initial stages of the game held a gap in their learning process, as they didn't fully understand their decisions and progress within the game. As in most cases, when a new tool or technology is integrated

in formal education, there is a need of ongoing support for students to become familiar with it, as soon as possible (Kearney et al., 2012). In order to achieve this, digitally literate educators must act as facilitators in specialized design implementations, where students will be timely, actively and directly engaged in the learning process through game play (Kiger, Herro & Prunty,2012; Park, 2011).

The use of mobile videogames in formal educational contexts provides a series of opportunities for improving the learning process, despite several challenges already discussed. Formal education instructional designers should take in consideration the comparative advantages of mobile videogames, including the increase of motivation and engagement of students, the customized and skills-oriented learning (Moreno-Ger et al., 2008). In order to do so, they should develop their own capacity in using mobile devices and games, overcoming existing challenges of the curricula and deal with the potential learning curve of the students (Moreno-Ger et al., 2008).

5.6. Students perceptions of the importance of games' integration in education

In this chapter, I discuss how students assess the importance of games' integration in education. Analyzing these views, it provides insights into the implementation that can assist the design of future interventions and maximize its impact (Meyer, 2001). Students developed positive perceptions about the use of the game in education, as they thought that ~~the~~ collaborative game play supported the development of a variety of skills, empowered ~~the~~ content learning, and offered alternative educational modes of interaction and learning. This has been my 5th assertion.

Students claimed that the game supported the development of health literacy skills in an educational environment. Firstly, it seems from their statements, that they understood the skills associated with decision-making processes, as part of health literacy education. These skills were communication,

negotiation, networking, critical thinking, visualization and strategizing. As was discussed in previous chapters, health literacy is directly associated with a person's social skills, where citizens need to take decisions, negotiate, communicate, solve problems, reflect on their actions, assess information and think critically (Krumina, & Lubenko, 2016; Mogford, Gould, & Devoght, 2010). Therefore, it was extremely important to discover that students were consciously involved in a process of skills development, which they appreciated. As research suggests, educational environments which allow students to freely interact, communicate and collaborate, connected also with notions of social constructivism, are more supportive of thoughtful engagement in the learning process and self-reflection (Nicolaou et al., 2009; McBride & Xiang, 2004). This can also be read from a contrary perspective, where skills are better developed when the engagement of students in the learning process is self-regulated and contextualized (Pivec, Dziabenko, & Schinnerl, 2003).

The game structure, the controlled challenges, and the interconnections of the game story with real-life, made students develop positive perceptions of the game's impact on their health literacy skills. Moreover, students greatly appreciated the impact of collaborative and negotiated play on their skills and knowledge upgrade. Students appeared to comprehend that the skills they were developing were associated with decision-making processes, as well as health literacy skills.

Skills are more effectively developed in contextualized learning environments associated with real-life experiences of participants. In this context, students comprehended clearly that their decision-making skills were developed through their interaction with health issues, which can be transferred to their day-to-day life (Nicolaou et al., 2009; Ioannou et al., 2014). Moreover, the independent engagement of students in this initiative and the negotiation of meaning and

understandings with other peers have been highly supportive of the overall learning process (Kiger, Herro & Prunty, 2012; McBride & Xiang, 2004).

For health literacy education, students needed to be engaged in an authentic learning process, where it would resemble, in the best way possible, the challenges they will encounter in real-life. Students argued that authentic learning developed their communication, negotiation, critical thinking, collaboration, creativity, and visioning skills. A progress achieved through mobile videogames and collaborative play (Arnab et al., 2013; Olson, 2010). While students were dealing with the case study complexities, they were developing their capacity to transfer knowledge and skills to real-life (Nicolaou et al., 2009; Raphael et al., 2010).

Beyond the development of skills, the *PlayForward*: *Elm City Stories* has, as a primary objective, to equip students with information and knowledge related to healing and well-being issues. Therefore, I wanted to also investigate whether the game was effective in meeting this objective, since the game was not exactly designed for negotiated play, and this may have influenced its educational impact. From the data analysis, I concluded that students believed that they acquired content knowledge related to health literacy. On many occasions, students argued that they learned through the game about sexual transmitted diseases and other related issues of well-being. Students, also, argued that they shared knowledge on health issues with their peers in the groups. Many students claimed that to make informed decisions, they had to thoughtfully discuss with others, connect previous knowledge and experience, and reach the best option in the mini-games challenges. Such a process is fully aligned with the principles of the social constructivist pedagogical model. I found this to be an extremely important outcome for the integration of game in education, registering how a game's educational impact is maximized through collaborative and negotiated play. It has always

been a challenge for educators to develop learning programs for health literacy. This is because they had to, at once, meet students' content knowledge needs, and design an intervention that would be motivational and engaging for students. We can argue that such a challenge can be addressed through videogames and negotiated play (DeSmet et al., 2014). Health literacy games build up knowledge that can be utilized immediately, initially within the game play environment, and consequently in the real-life of gamers. In this context, and contrary to other learning initiatives, students thoughtfully try to acquire as much content information as possible in order to succeed within the game. In such a process, they comprehend that this knowledge is also transferable to life outside the game ecosystem (Arnab et al., 2013). Furthermore, skills and literacy-oriented games must provide the context to deploy relevant existing knowledge and motivate them to build it up. Such a learning environment would be similar to the current case implementation in a negotiated play mode, wherein the decision-making process would be central to their collaboration (McCallum, 2012; Bo Xie, 2011; Fuchslocher et al., 2011).

However, some students argued that the game's theme was not appropriate, as they were never taught anything on issues related to sexual education, and it was difficult for them to become fully engaged in the game. This is a systemic problem of the Cyprus Education System since, despite the efforts of stakeholders in Cyprus, sexual education in formal education remains fragmented (Ioannou et al., 2014). Nevertheless, the majority of students noted that one of the most interesting features of the game was the provision of information on health issues, in a contextualized manner, relevant to students' experiences.

A central reference point of students' views on skills evolution was the differentiation of learning, based on collaborative learning. The departure of the learning process from the formal

teacher-centered approach to a hybrid informal process, where students control knowledge inflow and interactions, stimulated their ongoing engagement. As students were assigned the responsibility of building up their skills and knowledge, this has been highly valued by many researchers as engaging, effective and motivational, where students develop their cognition, skills and content awareness through mobile videogames (McBride & Xiang, 2004; Kearney et al., 2012; Looi et al., 2010; Su & Cheng, 2013; Attewell, 2005).

Health literacy is not just health education, it is also the development of a series of social skills which will allow young citizens to deal with complex well-being and health challenges in society (Mogford, Gould, & Devoght, 2010). Therefore, it is critical for the advancement of such knowledge and skills to provide students with the opportunity for collaborative learning, as a social orientation process (McBride & Xiang, 2004). Students felt that the ongoing interaction with their teammates helped them develop their critical thinking, negotiation skills, and a sense of collective responsibility, through thoughtful engagement, and real-life contextualization (Kiger, Herro & Prunty,2012; Pivec, Dziabenko, & Schinnerl, 2003; Miller et al., 2013; Xie, 2011).

To conclude, students greatly appreciated peer-to-peer knowledge exchange on health literacy. Such a theme remains a taboo in Cypriot schools, and students have limited opportunities to discuss and be educated about such an issue (Lesta et al. 2008). Therefore, having the opportunity to be informed through the game about these themes and discuss them in their teams, appeared to be beneficial and attractive for their engagement. Finally, students argued that through peer-to-peer support, the game and its content became comprehensive and relevant, since many of their knowledge gaps were filled by other members of their team. Building on this collaborative practice, students kept their motivation and conscious engagement in the game play process. Negotiated play on gaming

platforms constitutes a form of a community of practice, where participants learn from each other collectively, based on the internal dynamics, capacities and pace (Whitton, & Hollins, 2008; Lave & Wenger 1991). Students seemed to enjoy peer- to-peer support, as they felt they were contributing to the skills and knowledge development of their teammates (Olson, 2010; Bofill, 2013). Peer-based and negotiated play, assigns different roles to participants, at different stages of the process, providing them with the opportunity to investigate and reflect on multiple features of their skills, knowledge and character (Simões, Redondo, & Vilas, 2013; Olson, 2010).

6. Summary, Limitations, Recommendations, and Conclusions

6.1. Summary

The primary aim of the study "The use of mobile videogames in education: The Case of Elm City Stories" was to investigate the impact of mobile videogames on the learning and skills development of a group at secondary school and in an after-school context, through collaborative play. My primary interest in this study was to examine how the mobile videogame *PlayForward: Elm City Stories*, affordances, narrative and usability, facilitated a decision-making process on health issue, and how it empowered health literacy skills. The term health literacy is used in this study to refer to the nexus of "social and cognitive skills" which defines the capacity of persons to access and manage health related information through active interaction, participation and critical analysis (World Health Organization, 2013).

The mobile videogame used for this case study, incorporates evidence-based concepts from prominent behavior change theories, including self-efficacy, social norms, message framing, and delay discounting, as noted by the game's development team of the play2PREVENT Lab Yale

University in the US (Elm City Stories http://www.play2prevent.org/). *PlayForward* is an interactive world in which the player, using an Avatar (virtual character) they have created, "travels" through life, encountering challenges and making decisions that bring different risks and benefits. Players have the ability to see how their choices affect their lives and subsequently, are able to move back in time to see how different actions might have led to different outcomes. By negotiating challenges in a highly-repetitive and meaningful way, players learn skills that translate to real life, equipping them to avoid situations that increase the risk of smoking and alcohol use, and other possibly negative health outcomes.

"Single Case Study Research Methodology" was used as a methodological approach to address the goal of the study (Dul, & Hak, 2007; Meyer, 2001; Miles, 2015; Zainal, 2007). A single case study approach allows for a deep exploration of students' engagement with the game, along with the collection of data from various sources of information, such as video-based observations, interviews, as well as an analysis of the game-output (Merriam, 2009). Case study design is considered one of the "most flexible of all research designs", which provides the opportunity for an in-depth investigation of "real-life events while investigating empirical events" (Schell, 1992, p. 2). The case study methodology is appropriate for framing the design of this study, given that case studies are usually used to investigate behaviors, social interactions, and skills development with a particular emphasis on decision-making (Schramm, 1971, p. 6). A central pillar of this research is the examination of decision-making processes through negotiated play. Particular focus is placed on the limitations and challenges of taking a decision, and the nature of blurry boundaries that influenced it (Miles, 2015). Case design, implementation and analysis is fully appropriate for such a challenge

(Baxter & Rideout, 2006), where a non-formal educational environment in a private school, provides the opportunity for a decision-making game play.

The case study implementation took place in a private school in the suburbs of Nicosia, Cyprus, with the voluntary participation of 15 students of lower secondary education. The implementation was conducted in the after-school hours for 5 weeks (8th of February, 2016-9th of March, 2016), at 2 hours per week. Students were grouped in teams of 3 and played the game, collaboratively. The data collected from the case study implementation were as follows:

- Video-taped interactions of each group of students (5 meetings x 1.5 hours)
- Game-logs for each group of students
- Field research notes
- Researcher's diary (6 diaries, 2 A4 long each)
- Post-implementation semi-structured interviews with each student (40 minutes long)

The data analysis was based on two stages, the inductive and the deductive (Stake, 2011; Patton, 2002). At the inductive stage, the data collected were coded and classified in categories, using opencode techniques (Glaser, 1978). These categories were reviewed, resulting in higher-order categories, by merging or rejecting previous sub-categories or labels. Based on the higher-order categories and the coded data, I developed five assertions, which are statements that give a sense of generalization through a data cross-analysis. At the deductive stage, there was a process of validating or rejecting the assertions. This process required a cross-checking between different categories, to identify overlaps or intersections of supportive or contradictive data, eventually validating, rejecting

or merging the assertions. The final assertions were validated based on the data analysis and coding. These assertions are:

1. The affordances of the game, such as the variety of play modes, the technical aspects of the game (sound, usability, rating system, and visuals), the support of collaborative play, the game narrative connections to real-life contexts, and the potential for skills development, guided the learning game-play experience of students.

2. Students believed that their participation in the *PlayForward*: *Elm City Stories* mobile videogame implementation case study, facilitated their engagement in decision-making, and developed their communication and critical thinking skills, in a conscious and comprehensive manner; however, in reality their participation in decision-making didn't illustrate the negotiation of ideas.

3. Negotiated and collaborative play in teams shaped social gaming trajectories, such as students' interpersonal relations, reflections on students' own life experiences, and discussions beyond the game's themes.

4. Integration of the game for health literacy education, generated a series of opportunities and challenges, such as the attractiveness of the collaborative play and learning, the promotion of a customized/needs-oriented learning, the bridging of formal and non-formal education modes, and the appearance of a learning curve, which students need to go through to become familiar with the game.

5. Students developed positive perceptions about the use of games in education, since they thought that collaborative game play supported the development of a variety of skills,

empowered them to learn the content, and offered alternative educational modes of interaction and learning.

The outcomes of the data analysis, based on the abovementioned assertions were further discussed and crossed-checked with the international literature on educational mobile videogames, skills development and collaborative learning. Building on the data analysis and discussion, relevant recommendations for practitioners and researchers emerged. The detailed accounts of the case study didn't intend to provide an undisputed prescription of mobile videogames' integration in education, but to sketch my own experiences and challenges I came across during this research adventure. With this research report I tried to take a glance, and share it, on what a mobile videogame implementation looks like in the given conditions, with specific participants and with a particular research team. Various instructional designers, educators, policy makers, game developers and researchers may identify with some aspects of this research, detect elements that could inform their own work or even identify gaps they should avoid. As argued earlier in the research, any educational intervention should be needs-oriented, customized and contextualized towards its target groups.

6.2. Limitations

The research confronted several limitations in its overall implementation and analysis, which we need to take in consideration when assessing the current case study, as well as when providing recommendations.

An initial limitation of the implementation was the selection of the specific game. The *PlayForward: Elm City Stories* video game was designed for a US context and addresses issues which are more relevant to the educational background of US students. This has been a challenge for some

students, as they stated that due to the absence of a former relevant knowledge on health literacy, their thoughtful engagements were fragmented on some occasions. Such a limitation was addressed on many occasions by the groups collectively, as discussed in the data analysis. None of the students had all the information knowledge to address health literacy challenges in the game, however, the peer-to-peer support within the groups was supportive enough to empower all group members' engagement.

Another limitation related to the game was the fact that the game was designed for a single play mode. However, due to the play format and game missions requirements, it proved to be usable for collaborative play, too. The game missions, in multiple phases, required a decision on close- ended questions. This format supported the development of negotiations and a decision-making process among students.

Regarding the game's technical and design limitations, these were, to a certain extent, expected, and was an affordable risk since our primary research objective was to test the specific game, and the specific topic of health literacy in the Cypriot context.

A limitation related to the method would be the small number of students that participated in the case study implementation. In previous research, where the specific game was used, the target group number was more than 100 students. Nevertheless, all previous research was exclusively based on quantitative data generated by the game itself, and therefore, it had been more manageable. This research was focused on the social interaction among students, the skills development and discourse where the implementation occurs and data were collected through qualitative approaches. Bigger numbers of target group members would require excessive time for data analysis, and more resources to be collected and analyzed.

Finally, another limitation of the research is that, as a single case study, it has limited generalization potentials. The game tested was deliberately selected, as well as the type of the school (private school). The case study was exclusively focused, and analyzed the specific game in the specific educational context. Therefore, it would be a challenge to argue about the extensive potentials of generalization. In any case, the purpose of the single case study research method and qualitative research is to investigate extensively, and in detail, the interactions of the research objects in the ecosystem where they occur, and not necessarily offer an opportunity for generalizations (Mason, 2002; Shenton, 2004). Nevertheless, the overall description and an analysis of the implementation ecosystem, may provide selective practices and insights for videogames' integration in education.

6.3. Recommendations for Practitioners

One of my main goals in this research was to sum up some recommendations for practitioners (game developers, instructional designers, educators, decision-makers), on the use of educational mobile videogames, as they derived from the experience and knowledge acquired through this research. These recommendations are not a panacea for all educational mobile videogames challenges, but just my own small contribution to the field. The recommendations will be presented under headings linked with the assertions' data analysis and discussion.

6.3.1. Game affordances and narrative

In what follows, I will first provide several recommendations related to the technical affordances of the game related to its functionality, appearance and game mode, while, in the second part, I will focus on the game's narrative.

Technical affordances of any game are critical both for the target groups and the stakeholders, and must be addressed as primary challenges (Koole, 2009; Naismith al., 2004; Strack, Magill & McDonagh, 2004), when designing a game implementation. Therefore, game designers, instructional designers and educators must be fully aware of the digital literacy levels and familiarity of their target groups and stakeholders with mobile videogames. I have to admit that, in the current case study, I was fortunate to have 15 students, who were highly competent in playing online games. This minimized the learning curve of the students, and the need of an induction session on both how to use the i-Pad and play a mobile videogame. Similarly, instructional designers need to identify the capacity of teachers in effectively integrating and utilizing games for educational purposes, at the design phase.

Moreover, game developers, teachers and instructional designers, need to align the visuals and sounds of the game with the overall pedagogical framework and game theme. This way, they will maximize the game's contextualization, improve the gaming experience and attract students' mindful engagement (Arnab et al., 2013; Ke, 2009). Games maximize the motivation of students to learn when they provide an environment of mystery that triggers their fantasy. Such features are associated with the visuals' design, sounds and game storyline (Sherry et al. 2006; Wilson et al. 2009). As was observed during the implementation, the game graphics and sounds were attractive to students and helped them become attached to the game scenario. This has also been identified as a comparative advantage of games over traditional educational modes (Tüzün, Yılmaz-Soylu, Karakuş, İnal & Kızılkaya, 2009). Therefore, game, graphic and instructional designers need to collaborate, to align the abovementioned technical affordances of the game with its pedagogical purposes and learning objectives.

As evident in the analysis of the data, educational mobile videogames are considered valuable, if they trigger the interest of students through a variety of challenges, gaming formats and task-oriented missions (Simões, Redondo, & Vilas, 2013; Collins & Halverson, 2010). Additionally, the variety of challenges will offer the opportunity to instructional designers to target a wide range of skills, include a variety of experimentation challenges, and transmit different types of knowledge (McGonigal, 2011; Stokes, 2012). The games must secure an ongoing interaction of students with the overall play ecosystem, and avoid having long gaps without play action. This has been one of the major shortfalls of the game, as argued by students.

A critical feature of any mobile videogame is its scoring and rating system. Especially in an educational mobile videogame, keeping the score supports students' reflection on their progress in the game, empowers their engagement, controls their learning pace, and evolves their strategy and planning skills. The side effects of a game's scoring system are compatible with skills development (Whitton, & Hollins, 2008). Based on the data analysis from the video-recorded observations, the game's rating system has been a vital component of student control over their game play, thoughtful engagement and skills development. Therefore, interested practitioners when designing or using games will need to match the game's rating system with the play and the learning process of the users (Ke, 2009; McCallum, 2012).

Another important element of the games, linked with its affordances, are its play rules, guidelines and feedback. The play rules for educational games are essential in providing the space and opportunity for gamers to experiment without worrying that if they make an error they will have to restart the game. This way, they will be able to try various reasoning paths, which are associated with knowledge contextualization and game play authenticity (McGonigal, 2011; O'Neil et al., 2005).

With regards to the game guidelines observed in this research, as on many occasions, are essential for empowering students' mindful engagement. Moreover, guidelines are essential for the facilitators to better understand the game and provide support (Ke, 2009; McBride & Xiang, 2003;) Lastly, students greatly appreciated the feedback they were getting from the game and the various pop-ups regarding their next steps, errors or new knowledge. Direct feedback adds to the authenticity of the game play, empowers the game play learning process, and supports students' thoughtful participation (Amiel & Reeves, 2008; Collins & Halverson, 2010; Moreno-Ger et al., 2008; O'Neil, Wainess & Baker, 2005).

Game design and development should adopt an interdisciplinary approach in which technical affordances will be aligned with the learning objectives and the contextualization of skills and knowledge to be developed, through visuals, sounds, play mode and narrative (Stokes, 2012). The game narrative and storytelling are components that carry all game affordances associated with the learning and educational directions of the game (Flyvbjerg, 2006; Pivec, Dziabenko, & Schinnerl, 2003). As argued in the previous chapter, the designers of online games must not only approach the game design process as if constructing artefacts, but more like assembling a "social practice" (Amory, 2007, p. 67), or a social ecosystem. In this ecosystem, choices, characters, contexts, imagination/fantasy, challenges, and the narrative should interplay and interact between them and with gamers, cultivating their game and learning experiences (Veermans & Cesareni, 2005). It is in this framework that many students argued in favour of the *PlayForward* narrative since it was directly linked with their life experiences.

Research in educational games directly connects the element of fantasy with the game narrative. Therefore, a well-situated story will provide the opportunity for students to develop their transferability, visualization and problem solving skills (Amory, 2007; Dickey, 2006; Habgood,

2007). The story of a game must evolve through a variety of short missions, tasks and mini-games, have different chapters and episodes, where the player will be able to make various choices and face a number of challenges. Especially, in a collaborative mode, this will trigger decision-making processes, shared visioning and planning, collective metacognition and conscious engagement (Dickey, 2007).

As was emphasized above, it is significant for the games' storytellers and designers to provide a narrative and play mode with multiple opportunities of interaction; however, this constitutes one of the bigger challenges in game design. A repetition of missions' format would be highly demotivating for students (Bennett et al., 2009; Montgomery et al., 2004). As noted in the findings, students thought that, at times, the game was repeating itself. This has been a common complaint by students. Therefore, the games' storytellers should write down a narrative which gives meaning to the gaming experience, aligns play experiences to real life, while it provides multiple opportunities to users to visualize their skills development (Stott & Neustaedter,2013; Kapp, 2012; Clark & Rossiter, 2008; Salen, 2008).

Hence, for a game to fulfil its potentials, it is imperative that the whole spectrum of practitioners, stakeholders and target groups be involved from the design phase. Each interested part has its own valuable contribution to make to the technical affordances of the game, in the narrative authoring and its alignment with the intended learning objectives. Such an approach, provides a contextualized output, compatible with the educational context to be implemented, and highly attractive and fun for the end users.

6.3.2. Decision-making, skills development and collaborative play

One of the research questions of the study was to examine how the game facilitated the decision-making process and how the overall case study design and implementation contributed to the skills development process. A decision-making process encompasses a series of health literacy skills, including critical thinking, visualization, leadership, and negotiation, and therefore, the integration of such a process in an educational context is highly valuable (Baysal, 2009; Hernandez, 2013; Powell, & Kalina, 2009; Smith, 1998).

Negotiated play mode is useful when teachers integrate new technological tools in their courses. In such cases, students support each other in using this new technology (Attewell, 2005). Additionally, collaborative learning approaches provide the resources for all students to better comprehend learning themes and objectives in a social constructivist framework, as they develop a series of health literacy skills (Kiger, Herro & Prunty, 2012; Whitton, & Hollins, 2008).

The instructional design of case studies, which target the development of decision-making skills, need to follow collaborative problem solving approaches, in a scaffolder learning environment (Jimenez-Aleixandre & Pereiro-Munoz 2005; Nicolaou et al., 2009). Such an environment can be provided by an educational mobile videogame implemented in a negotiated play mode (Kiger, Herro & Prunty, 2012).

Decision-Making Facilitation

Decision-making process encompasses the development of a series of skills linked to health literacy. The game design and ecosystem can simulate real-life conditions, which foster a decision-making process (Linehan et al., 2009). The combination of using mobile videogames as educational

tools, through negotiated play, are fully compatible with the learning objectives of health literacy, linked to problem solving, experimentation, negotiation, communication and visualization skills (Raphael et al., 2010).

In terms of decision-making, as shown in the findings, the *PlayForward* was not fully efficient in facilitating a quality decision-making process. Students, although negotiating to make a decision, their arguments didn't include any rhetoric related to ideas, or opinions about the game theme. The repetition of missions led students, during the last sessions of the game, to make decisions mechanically, with limited content-related argumentation. Also, the challenges, in many cases, were camouflaged close-ended questions, which demotivated students to investigate likely answers or elaborate an opinion. For a game to trigger a negotiation of ideas and raise content-related argumentation, it must provide features of research outside the game (i.e., through the internet), or provide missions with open-ended challenges (Linehan et al., 2009). To conclude, the games' design and development must be more sophisticated, along with a multimodal approach to learning, including follow up reflections on the game play experience (Whitton, & Hollins, 2008).

In the Cypriot context, the absence of sexual or health education in the formal educational system, limited the deployment of content-related argumentation from students. In order for students to be fully engaged in a valuable and educative decision-making process, they need to have a basic understanding of the issues under negotiation (Nicolaou et al., 2009). Games' integration, in any educational context, needs to take in consideration the level of knowledge and skills of students and educators. If initial thematic knowledge is absent, the mobile videogames can be integrated in later stages of a course.

Nevertheless, students have been engaged consciously in decision-making processes, where they developed a series of skills, including being creative in reaching a consensus. Such practice of reaching a final decision, included voting, assigning a leader to make a final decision, or timely negotiation. These adaptations and flexibilities of students following multiple paths in reaching a final decision are characteristics of effective educational games (Robertson & Howells, 2008). Instructional designers and educators could consider the *PlayForward* videogame as a good example of a game that facilitates the development of such practices.

Empowered Collaboration

Collaborative learning with a focus on skills development appears to be more effective in meeting its objectives, in contrast to traditional educational modes with individualistic and competitive approaches (de Freitas & Oliver, 2006; Hummel, Paas, & Koper, 2006; Skon, Johnson, & Johnson, 1981). Collaborative learning initiatives, which are designed through task orientation, and experimentation, and promote ongoing interaction in groups, maximize their impact on skills development, linked to health literacy (Arnab et al., 2013; Lund, 1992; Perkins, 1999). Currently, such a learning framework can be fully supported through mobile videogames and negotiated play (Kiger, Herro & Prunty, 2012). As reported in the findings, negotiated play appeared to be highly attractive to students, securing an ongoing integration with the game and team. Therefore, game designers should develop games that are task-oriented, with short missions and a variety of challenges. A learning intervention, based on these components can effectively build the health literacy of students, contributing to their comprehension of complex health issues, and motivate them to deploy collaboration, creativity, contextualization and critical thinking (Hieftje, Duncan, & Fiellin, 2014).

The decision-making process must take place in an environment of free expression, where students will be "owners" and responsible for their decisions (Baysal, 2009). These elements of implementation and negotiated play were provided in the current case study. As students stated, in this mode they became more conscious about their skills development, had opportunities of reflection, while their motivation to learn was maximized (Olson, 2010). Therefore, any initiative that envisions the development of skills related to decision-making, needs to secure the autonomy of students to express themselves, to manage their gaming pace and to control their learning pace.

Skills Development

Health literacy encompasses a wide range of social skills, as citizens are required to make decisions, communicate, solve problems, reflect on their actions, assess information, and think critically (Krumina, & Lubenko, 2016; Mogford, Gould, & Devoght, 2010). Specifically, health literacy translates to "the opportunity to be part of a decision-making process for creating a supportive environment for desirable health behaviour" (Ioannou et al., 2014). According to prior research, such skills evolve in contextualized learning environments, where students have the space and flexibility to interact, communicate, collaborate and experiment with peers (Nicolaou et al., 2009; Pivec, Dziabenko, & Schinnerl, 2003). Such an educational environment also supports the capacity of student metacognition and thoughtful engagement in the overall learning process (McBride & Xiang, 2003). However, there are limited initiatives that support students' collaboration and interaction, contextual learning and critical thinking (Arnab et al., 2013; WHO, 2010). Therefore, instructional designers and educators targeting the development of social related literacies and skills could find in the current case study, elements that can help them develop a valuable learning program. Such a program should be advanced on the pillars of contextualization, collaboration and experimentation.

Contextualization is emphasized in all aspects of the current research, as it is a central element for the development of social skills based on health literacy. Simulations of real-life conditions support students' understanding of the importance of their active engagement, and skills are developed effectively and visibly, while they also build their capacity to transfer knowledge and skills to their day-to-day life (Nicolaou et al., 2009; Ioannou et al., 2014). These features are characteristics of the mobile videogames, and affordances (Miller et al., 2013; Kiger, Herro & Prunty,2012; Moreno-Ger et al., 2008; McBride & Xiang, 2003).

6.3.3. Educational challenges and opportunities

There are many reports, directives and research arguing that traditional education is always a step behind technological progress (Bennett, Wells & Rank, 2009; Bennett, 2008; Bennett, Jenkins, Clinton, Purushotma, Robinson, & Weigel, 2007; DeSmet et. Al., 2014; Wells & Freelon, 2009). Such a shortfall is primarily related to the fact that any new technology integrated in formal education, does not challenge top-down pedagogical models (Amiel & Reeves, 2008). Moreover, formal education lacks the contextualization of knowledge and skills, especially in themes related to social skills and health literacy, focused mainly on the transition of information, data and historical facts (Duncan, & Fiellin, 2014; Hernandez, 2013; Hill, 2004; Lesta, Lazarus, & Essén, 2008). This results in the low capacity of citizens to address challenges related to health literacy (Kutner, Greenberg, Jin, & Paulsen, 2006; Xie, 2011).

In an evolving globalized world, health literacy is of paramount importance, and the overall educational system has to become compatible with the learning needs of citizens, who need to be networked, engaged and informed (Hernandez, 2013; Xie, 2011). Therefore, any health literacy education initiative has be needs-oriented and provide opportunities for collaboration, peer-to-peer

learning, and problem solving, in an era of sophisticated, mobile and personalized information and communication technologies (Institute of Medicine, 2009; Oh, Rizo, Enkin, & Jadad, 2005; Xie, 2011).

As the World Health Organization states, health literacy is the nexus of "social and cognitive skills", which define the capacity of persons to access and manage health related information, through active interaction, participation and critical analysis (World Health Organization, 2013). However, policy makers, school leaders and teachers either neglect the multidimensional social aspects of health literacy, or prioritize/stress incorporating health literacy in formal contexts, which keeps it fragmented from the wider social ecosystem. This is an approach, which I tried to challenge through this research, by investigating the educational impact of mobile videogames on non-formal education modes. In order for mobile videogames to be integrated in formal education, the curricula must provide flexibility in time, space and pedagogies for their full potentials to be utilized (Jenkins et al., 2007; Moreno-Ger et al., 2008; Raphael et al., 2010; Rice, 2007).

The use of mobile videogames in education can bridge formal and non-formal educational modes of delivery (Looi et al., 2010). Such a progress would be valuable for students, as was concluded from the data analysis of the current research. Students can learn in formal education settings (such as, classrooms or schoolyards) about themes that are not directly linked with the curriculum, by using mobile devices provided by the school, or by participating in thematic clubs. Despite research on the educational impact of mobile videogames being at its beginning stages, it can be argued that education policy makers need to create the framework to bring non-formality into formal settings. Such progress would maximize the attractiveness and impact of any learning initiative (Looi et al., 2010). Focusing on the Cyprus case, the challenges of mobile videogames integration in

education, along with themes related to health literacy, as addressed by the *PlayForward* game, would also require a cultural and political shift. Such shifts can be accomplished only from a bottom-up campaign, in which educators would extensively introduce mobile videogames in their classrooms. This can be done by taking advantage of/acquiring a critical perspective on the narrow levels of flexibility they have, as enforced/instituted by the centralized curriculum of the Cyprus formal education authorities (Ioannou et al., 2014).

Nevertheless, the success of mobile videogames integration in education is not to be taken for granted. In the present case study, some students found a series of limitations, such as the friction among students, the long duration of some decision-making processes, and the disengagement of some students. Therefore, such initiatives would require the presence of a well-equipped facilitator, technically and pedagogically. The facilitator could provide some support in terms of content understanding to speed up decisions, motivate the engagement of all students, and manage wherever appropriate, any friction created within groups (McBride & Xiang, 2003; Ke, 2009). Moreover, the facilitator could trigger discussions or support an interdisciplinary approach to the learning process. As in real-life, students could jump from one issue to another discussing technology or personal issues, making the whole learning process more attractive to them (Kiger, Herro & Prunty, 2012; Park, 2011).

Lastly, both instructional designers and educators need to consider the learning curve students need to cover, to be fully engaged in the play mode. This has been a challenge for the *PlayForward* case study implementation, despite the fact that all students were familiar with the use of mobile videogames. The learning curve, and delays of full engagement by students, is a common observation, where new technology or learning approaches are introduced (Kearney et al., 2012). Therefore, lesson

plans which foresee the use of mobile videogames must consider the time needed for students to become familiar with the play mode, while educators need to be prepared to provide technical support to its students (Kiger, Herro & Prunty, 2012; Park, 2011).

Future Research

The ongoing work in designing, analyzing and reporting the *PlayForward* case study stimulated the vision to suggest, and potentially, pursue future research projects in the field of educational mobile videogames. Suggested future projects may come to cover gaps observed in current research, or take it a step forward, providing a more holistic approach to mobile videogame integration in education.

The current research was implemented in a private school, where students have the privilege of having regular access to mobile devices and mobile videogames. The question then raised is whether the use of mobile videogames in public schools, and any implementation of this kind, would be more challenging given that the heterogeneity of students' socio-economic backgrounds is greater (e.g., not everyone has access to a mobile device). Hence, it would be valuable for game developers, instructional designers and educators to offer insights on the relation between students' demographics (age, gender, living standards, socio-economic background) and educational mobile videogame attractiveness and impact.

The educational mobile videogame case study was implemented in a formal education environment under a non-formal educational design. Therefore, in the future we would need to test the practicalities, dynamics, and challenges, if the educational mobile videogame is implemented and tested in a formal educational context. This type of research would potentially collect data from more resources, and would need a more organized and coordinated research design implementation-because

we would have to deal and assess the role and reflections of teachers, school staff, and students' parents in a pre-set timeframe and inflexible environment.

A gap that future research would have to address, regarding the integration of mobile videogames in education, is the design, development and implementation of valid, sound and formative assessment practices of the games' impact on learning. In the current case study, data collection was focused by way of video-recordings of observations, students' post-implementation interviews, and my field notes. Assessments of the game impact on students and their reflections on it, could also occur several months ~~from~~ after the game implementation through questionnaires, interviews with facilitators, peer-to-peer evaluation, and interviews. . Moreover, in the formal educational context, if mobile videogames are used, summative and formative assessments should be developed to track the learning progress of students.

As one of the findings of the data analysis indicated, not all students were aware of health literacy related knowledge, since in the Cyprus context sexual education remains fragmented. This gap has limited the negotiation of meanings and ideas during the decision-making processes of the game implementation. Following previous research (Ioannou et al., 2014), it would be worthwhile to investigate potential progress on the quality of decision-making among students, if they were playing a mobile videogame with a more familiar theme. Results of such research would be helpful for instructional designers and educators in choosing the appropriate games and designing adjusted lesson plans. Also, it would be valuable if game developers aligned the themes of their games with the cultural and educational context in which they foreseed implementing them.

The current implementation was based on a single case study methodology. Although, I argued, for research control purposes, in favor of the validity of this research approach, it would be

valuable to assess the game through multiple case studies, in a variety of contexts, in order to produce more generalizable claims. Such an approach would provide us with important insights regarding large-scale implementations, and yield to information with respect to the ways in which context impacts the outcomes of game implementation.

Focusing on the impact of mobile videogames, it would also be valuable to investigate the distant collaborative play mode, where students may be located in different classrooms, schools or countries. Such research would expand educational potentials, and provide instructional designers and educators with the tool to implement networked learning activities across spaces. Moreover, such an applied research project could incorporate in its learning process, the wider community, theme experts, and parents. Distant collaborative play would situate learning in the core of health literacy, as students would be able to outreach and interact with other communities and cultures through an attractive and engaging game environment.

Lastly, future research with more participants and parallel case study implementation would allow researchers to examine the educational role and the impact of game design and its affordances. Some data of the current research overlapped the learning impact of the game itself with the overall case study pedagogical design. Therefore, multiple trials should take place to assess collectively, and separately, the learning impact of mobile videogames and collaborative play.

6.4. Conclusion

Research shows that young students are extremely critical in hierarchical modes of knowledge transmission (Bennett, 2008). Educational mobile videogames in a negotiated play mode are evolving to challenge this notion and the status quo of the top-down transmission of knowledge (Boyd, 2014).

Such virtual environments are easily accessible and attractive among school students, through which they can communicate, interact, become informed and play. Hence, it is envisioned that in the near future, mobile videogames will become a popular educational environment, where youth will have a direct interaction and creation of various formats of content (text, videos, visuals), communication, freedom of expression, and action (Bennett et al., 2009; Bennett, 2008). Educational games will not be successful just because they are games. Research will need to address the complexities hidden in the games' mechanics, the context of implementation, the heterogeneity of the users, and the usability within stiff educational systems. Therefore, it's important for future research to keep sketching new, innovative, multimodal patterns and pedagogies, associated with mobile videogames. Such patterns of mobile negotiated play should equip practitioners to utilize them in the wider social ecosystem.

As argued in earlier chapters, mobile videogames can be a valuable vehicle to build youth's capacity in health literacy skills, to become better informed, and actively engage with a globalized world. As Gee (2014) describes:

> Video games are a new form of art. They will not replace books; they will sit beside them, interact with them, and change them and their role in society in various ways. (…) We have no idea yet how people 'read' video games, what meanings they make from them. Still less do we know how they will "read" them in the future. Video games are at the very beginning of their potential – 'we ain't seen nothin' yet.' They will get deeper and richer. But for now, video games are what they are, an immensely entertaining and attractive interactive technology built around identities. I have made but one claim for them here. They operate with – that is, they build into their designs and encourage – good

> principles of learning, principles that are better than those in many of our skill-and-drill, back-to-basics, test-them-until they-drop schools. It is not surprising that many politicians, policymakers, and their academic fellow travelers who think poor children should be content with schooling for service jobs don't like video games. They say they don't like them because they are violent. But, in reality, video games do violence to these people's notions of what makes learning powerful and schools good and fair. (Gee, 2014, p.204)

In agreement with this view, I conclude this thesis with the realization that the stakes related to the use of mobile videogames in education are high, yet the possibilities are unlimited. As Dede and Nelson (2005) argue, the conditions for the success of educational technologies in schools include complimentary shifts in curriculum, pedagogy, assessment, professional development, administration, organizational structures, strategies for equity, and partnerships for learning among schools, businesses, homes and community. Research is crucial in better understanding the interactions between innovations, such as mobile videogames integration in education. Having completed the present work, I look forward to its sustainability and multiplication through further research. In this context, it is recommended that further research (a) exemplifies theoretical aspects and characteristics of design frameworks associated with learning through mobile videogames; (b) characterizes rich and complex pedagogical practices that use mobile videogames; and, (c) speaks with great detail of the processes by which students come to construct knowledge and develop skills through their engagement with mobile videogames, in both formal and informal contexts.

7. Bibliography

Allen, R. (2011). Can mobile devices transform education? *Education Update*, 53(2), 2–7. Anusen Inc. (2010). *Math magic* [software]. Available at http://itunes.apple.com/us/app/ math-magic/id291478690?mt=8

Allen, R. F. (2000). Civic education and the decision making process. Social Studies, 9 (1), 5-8.

Amiel, T., & Reeves, T. C. (2008). Design-Based Research and Educational Technology: Rethinking Technology and the Research Agenda. *Educational Technology & Society*, *11*(4), 29-40.

Amory, A. (2007). Game object model version II: a theoretical framework for educational game development. *Educational Technology Research and Development*, *55*(1), 51-77.

Andolina, M. W., Jenkins, K., Keeter, S., & Zukin, C. (2002). Searching for the meaning of youth civic engagement: Notes from the field. *Applied Developmental Science*, *6*(4), 189-195.

Annetta, L. A. (2010). The "I's" have it: A framework for serious educational game design. *Review of General Psychology*, *14*(2), 105.

Antle, A. N., Bevans, A., Tanenbaum, J., Seaborn, K., & Wang, S. (2011, January). Futura: design for collaborative learning and game play on a multi-touch digital tabletop. In *Proceedings of the fifth international conference on Tangible, embedded, and embodied interaction* (pp. 93-100). ACM.

Arnab, S., Brown, K., Clarke, S., Dunwell, I., Lim, T., Suttie, N., Louchart, S., Hendrix, M. & De Freitas, S. (2013). The development approach of a pedagogically-driven serious game to support Relationship and Sex Education (RSE) within a classroom setting. *Computers & Education*, *69*, 15-30.

Attewell, J. (2005). Mobile technologies and learning. *London: Learning and Skills Development Agency*, *2*(4).

Aubusson, P., Griffin, J., & Kearney, M. (2012). Learning beyond the classroom: Implications for school science. In B. J. Fraser, K. Tobin, & C. McRobbie (Eds.), *Second international handbook of science education* (pp. 1123–1134). Dordrecht: Springer.

Beale, R. (2006). How to enhance the experience without interfering with it. *Big issues in mobile learning*, 10-14.

Baert, V., Gorus, E., Mets, T., Geerts, C., & Bautmans, I. (2011). Motivators and barriers for physical activity in the oldest old: a systematic review. *Ageing research reviews*, *10*(4), 464-474.

Baker, E. L., & Mayer, R. E. (1999). Computer-based assessment of problem solving. *Computers in Human Behaviour*, *15*(3), 269-282.

Bandura, A. (2001). Social cognitive theory of mass communication. *Media psychology*, *3*(3), 265-299.

Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The journal of the learning sciences*, *13*(1), 1-14.

Biggs, J., Kember, D., & Leung, D. Y. (2001). The revised two-factor study process questionnaire: R-SPQ-2F. *British Journal of Educational Psychology*,*71*(1), 133-149.

Battistoni, R. (2002). *Civic engagement across the curriculum.* Providence, RI: Campus Compact.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report*, *13*(4), 544-559.

Baxter, P., & Rideout, L. (2006). Decision making of 2nd year baccalaureate nursing students. *Journal of Nursing Education*, 45(4), 121-128.

Baysal, Z. N. (2009). An Application of the Decision-Making Model for Democracy Education: A Sample of a Third Grade Social Sciences Lesson. *Educational sciences: theory and practice*, *9*(1), 75-84.

Bell, B. (2005). *Children, youth, and civic (dis) engagement: Digital technology and citizenship*. Department of Communication Studies, Concordia University.

Bennett, W. L. (2008). Changing citizenship in the digital age. *Civic life online: Learning how digital media can engage youth*, *1*, 1-24.

Bennett, W. L., Wells, C., & Freelon, D. G. (2009). Communicating citizenship online: Models of civic learning in the youth web sphere. *A Report from the Civic Learning Online Project*.

Bennett, W. L., Wells, C., & Rank, A. (2009). Young citizens and civic learning: two paradigms of citizenship in the digital age. *Citizenship Studies*, *13*(2), 105-120.

Benbasat, I., Goldstein, D. K., & Mead, M. (1987). The case research strategy in studies of information systems. *MIS quarterly*, 369-386.

Berns, R. G., & Erickson, P. M. (2001). Contextual Teaching and Learning: Preparing Students for the New Economy. The Highlight Zone: Research@ Work No. 5.

Bers, M. U. (2008). Civic identities, online technologies: From designing civics curriculum to supporting civic experiences. *Civic life online: Learning how digital media can engage youth*, 139-160.

Biesta, G. (2006). What's the point of lifelong learning if lifelong learning has no point? On the democratic deficit of policies for lifelong learning. *European Educational Research Journal*, *5*(3-4), 169-180.

Biesta, G., Lawy, R., & Kelly, N. (2009). Understanding young people's citizenship learning in everyday life The role of contexts, relationships and dispositions. *Education, citizenship and social justice*, *4*(1), 5-24.

Bimber, B. (2003). *Information and American democracy.* Cambridge: Cambridge University Press.

Bimber, B., Flanagin, A. J., & Stohl, C. (2005). Reconceptualizing collective action in the contemporary media environment. *Communication Theory, 15*(4), 365-388.

Blumberg, F. C., Almonte, D. E., Anthony, J. S., & Hashimoto, N. (2013). *19 Serious Games: What Are They? What Do They Do? Why Should We Play Them?* The Oxford Handbook of Media Psychology, New York: Oxford University Press, pp. 334.

Blumer, H. (1969). *Symbolic interactionism: Perspective and method*. Englewood Cliffs, NJ: Prentice Hall.

Bofill, L. (2013). Constructivism and collaboration using Web 2.0 technology. *Journal of Applied Learning Technology, 3*(2), 31-37.

Bourgonjon, J., De Grove, F., De Smet, C., Van Looy, J., Soetaert, R., & Valcke, M. (2013). Acceptance of game-based learning by secondary school teachers. *Computers & Education, 67*, 21-35.

Boyd, D. (2014). *It's Complicated: the social lives of networked teens*. Yale University Press.

Brooks, J. G., & Brooks, M. (1993). *In search of understanding: The case for constructivist classrooms*. Alexandria, VA: ASCD.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences*, 2, 141-178.

Burnard, P. (1991). A method of analysing interview transcripts in qualitative research. *Nurse education today*, *11*(6), 461-466.

Bruner, G. C. II. (1993). *A census of multi-item scales used in marketing research* (Technical Report No. 9305). Carbondale, IL: Southern Illinois University, Office of Scale Research.

Campbell, D. E. (2005). Voice in the Classroom: How an Open Classroom Environment Facilitates Adolescents' Civic Development. CIRCLE Working Paper 28. *Centre for Information and Research on Civic Learning and Engagement (CIRCLE), University of Maryland*.

Carr, W., & Hartnett, A. (1996) *Education and the Struggle for Democracy: The Politics of Educational Ideas.* Buckingham: Open University Press.

Charsky, D. (2010). From edutainment to serious games: A change in the use of game characteristics. *Games and Culture*, 5(2), 177–198.

Chen, B., & Bryer, T. (2012). Investigating instructional strategies for using social media in formal and informal learning. *The International Review of Research in Open and Distance Learning*, *13*(1), 87-104.

Chen, C. H., Wang, K. C., & Lin, Y. H. (2015). The Comparison of Solitary and Collaborative Modes of Game-based Learning on Students' Science Learning and Motivation. *Educational Technology & Society*, *18*(2), 237-248.

Clark, M. C., & Rossiter, M. (2008). Narrative learning in adulthood. *New directions for adult and continuing education*, *2008*(119), 61-70.

Clements, D. H., & Sarama, J. (2014). *Learning and teaching early math: The learning trajectories approach*. Routledge. Clough, G., Jones, A. C., McAndrew, P., & Scanlon, E. (2008). Informal learning with PDAs and smartphones. *Journal of Computer Assisted Learning*, *24*(5), 359-371.

Cobb, P., Confrey, J., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational researcher*, *32*(1), 9-13.

Cogan, J., & Derricott, R. (Eds.). (2000). *Citizenship for the twenty first century: An international perspective on education (revised ed.)*. London: Kogan Page

Coleman, S. (2008). Doing IT for themselves: Management versus autonomy in youth e-citizenship. *Civic life online: Learning how digital media can engage youth*, 189-206.

Collins, A. (1992). Towards a design science of education. In E. Scanlon, & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15-22). Berlin, Germany: Springer.

Collins, A., & Halverson, R. (2010). The second educational revolution: Rethinking education in the age of technology. *Journal of computer assisted learning*, *26*(1), 18-27.

Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design Research: Theoretical and Methodological Issues. *The Journal of the Learning Sciences*, 13(1), 15–42.

Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data: complementary research strategies*. Sage Publications, Inc.

Crabtree, B. F., & Miller, W. L. (Eds.). (1999). *Doing qualitative research*. Sage Publications.

Creswell, J. W. 1998. *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.

Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper and Row.

Cunningham, D., & Duffy, T. (1996). Constructivism: Implications for the design and delivery of instruction. *Handbook of research for educational communications and technology*, 170-198.

Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and higher education*, *15*(1), 3-8. Darke, P., Shanks, G., & Broadbent, M. (1998). Successfully completing case study research: combining rigour, relevance and pragmatism. *Information systems journal*, *8*(4), 273-289.

Davies, P. (1998). Formalising learning: the role of accreditation. In *ESRC Learning Society informal seminar, Bristol*.

De Smet, A., Van Ryckeghem, D., Compernolle, S., Baranowski, T., Thompson, D., Crombez, G., Poels, K., Van Lippevelde, W., Bastiaensens, S., Van Cleemput, K. & Vandebosch, H. (2014). A meta-analysis of serious digital games for healthy lifestyle promotion. *Preventive medicine*, *69*, 95-107.

De Freitas, S., & Oliver, M. (2006). How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? *Computers & education*, *46*(3), 249-264.

Dede, C. (2004). If design-based research is the answer, what is the question? A commentary on Collins, Joseph, and Bielaczyc; diSessa and Cobb; and Fishman, Marx, Blumenthal, Krajcik, and Solo way in the JLS special issue on design-based research. *Journal of the Learning Sciences*, 13(1), 105-114.

Delli Carpini, M. X. (2000). Gen. com: Youth, civic engagement, and the new information environment. *Political communication*, *17*(4), 341-349.

Denzin, N. K. (1978). *Sociological methods: A sourcebook*. McGraw-Hill Companies.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining gamification. In *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp. 9-15). ACM.

Dewey, J. (1987[1937]). Democracy and educational administration. In J.A. Boydston (ed.) *John Dewey. The Later Works, 1925-1953. Volume 11: 1935-1937, pp.217-252.* Carbondale and Edwardsville: Southern Illinois University Press.

Dickey, M. D. (2006). Game design narrative for learning: Appropriating adventure game design narrative devices and techniques for the design of interactive learning environments. *Educational Technology Research and Development*, *54*(3), 245-263.

Dickey, M. D. (2007). Game design and learning: A conjectural analysis of how massively multiple online role-playing games (MMORPGs) foster intrinsic motivation. *Educational Technology Research and Development*, *55*(3), 253-273.

Downe-Wamboldt, B. (1992). Content analysis: method, applications, and issues. *Health care for women international*, *13*(3), 313-321.

Dul, J., & Hak, T. (2007). *Case study methodology in business research*. Routledge.

Duncan, L., Hieftje, K., Culyba, S., and Fiellin.(2014) "Game playbooks: tools to guide multidisciplinary teams in developing videogame-based behavior change interventions". Accessed on 27 Oct. 16 at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3958589/

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of management review*, *14*(4), 532-550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of management journal*, *50*(1), 25-32.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of advanced nursing*, *62*(1), 107-115.

Erentaitė, R., Žukauskienė, R., Beyers, W., & Pilkauskaitė-Valickienė, R. (2012). Is news media related to civic engagement? The effects of interest in and discussions about the news media on current and future civic engagement of adolescents. *Journal of adolescence*, *35*(3), 587-597.

Fiellin, L. E., Hieftje K., Edelman E. J., & Camenga D. R..(2013) "Play To Prevent Can Video Games Make Kids Healthier?." Accessed on 27 Oct. 2016 at http://footnote1.com/can-video-games-make-kids-healthier/

Fiellin, L. E., Hieftje, K. D., & Duncan, L. R. (2014). Videogames, here for good. *Pediatrics*, *134*(5), 849-851.

Fiellin, L. E., Kyriakides, T. C., Hieftje, K. D., Pendergrass, T. M., Duncan, L. R., Dziura, J. D., & Fiellin, D. A. (2016). The design and implementation of a randomized controlled trial of a risk reduction and human immunodeficiency virus prevention videogame intervention in minority adolescents: PlayForward: Elm City Stories. *Clinical Trials*, *13*(4), 400-408.

Flick, U. (2002) *An Introduction to Qualitative Research*, *2nd ed*. Thousand Oaks, CA: Sage.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative inquiry*, *12*(2), 219-245.

Freire, P. (1985). *The politics of education: Culture, power, and liberation*. Greenwood Publishing Group.

Fuchslocher, A., Niesenhaus, J., & Krämer, N. (2011). Serious games for health: An empirical study of the game "Balance" for teenagers with diabetes mellitus. *Entertainment Computing*, *2*(2), 97-101.

Gale, N. K., Heath, G., Cameron, E., Rashid, S., & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC medical research methodology*, *13*(1), 117.

Gee, J. P. (2008). Learning and games. *The ecology of games: Connecting youth, games, and learning*, *3*, 21-40.

Gee, J. P. (2014). What video games have to teach us about learning and literacy. Macmillan.

Gibson, C., & Levine, P. (2003). The civic mission of schools. *Report for Carnegie Corporation of New York and the Center for Information and Research on Civic Learning and Engagement. Disponible en: http://www. civicmissionofschools. org/site/campaign/cms_report. html*.

Glover, R. W. (2012). Games without frontiers? Democratic engagement, agonistic pluralism and the question of exclusion. *Philosophy & Social Criticism*, *38*(1), 81-104.

Grabinger, S., Dunlap, J. C., & Duffield, J. A. (1997). Rich environments for active learning in action: problem-based learning. *Research in Learning Technology*, *5*(2).

Grummell, B. (2010). Filtering informal learning in everyday life: Invoking ordinariness and moving to civic engagement. *International Journal of Lifelong Education*, *29*(5), 565-579.

Gulsecen, S., & Kubat, A. (2006). Teaching ICT to teacher candidates using PBL: A qualitative and quantitative evaluation. *Educational Technology & Society*, *9*(2), 96-106.

Gummesson, E. (2006). Qualitative research in management: Addressing complexity, context and persona. *Management Decision*, 44(2), 167-179.

Gummesson, E. 1988. *Qualitative methods in management research*. Lund, Norway: Studentlitteratur, Chartwell-Bratt.

Gumperz, J. J. (Ed.) (1982). *Language and social ident*ity. Cambridge: Cambridge University Press.

Habgood, M. P. J. (2007). *The effective integration of digital games and learning content* (Doctoral dissertation, University of Nottingham).

Hakim, C. (1987). Research design. *Allen Unwin, London*.

Hall, S. and Held, D. (1989) 'Citizens and Citizenship', in S. Hall and M. Jacques (eds) *New Times: The Changing Face of Politics in the 1990s.* Buckingham: Open University Press.

Halpern-Felsher, B. L., & Cauffman, E. (2001). Costs and benefits of a decision: Decision-making competence in adolescents and adults. *Journal of Applied Developmental Psychology*, *22*(3), 257-273.

Hamari, J., Koivisto, J., & Sarsa, H. (2014, January). Does Gamification Work?--A Literature Review of Empirical Studies on Gamification. In *System Sciences (HICSS), 2014 47th Hawaii International Conference on* (pp. 3025-3034). IEEE.

Hense, J., & Mandl, H. (2014). Learning in or with Games?. In *Digital Systems for Open Access to Formal and Informal Learning* (pp. 181-193). Springer International Publishing.

Harrell, M. C., & Bradley, M. A. (2009). *Data collection methods. Semi-structured interviews and focus groups*. RAND NATIONAL DEFENSE RESEARCH INST SANTA MONICA CA.

Hartley, J. F. 1994. Case studies in organizational research. In Qualitative methods in organizational research: A practical guide, edited by C. Cassell and G. Symon, 209–29. London: Sage

Haste, H. (2010). Citizenship education: A critical look at a contested field. *Handbook of research on civic engagement in youth*, 161-192.

Hernandez, L. M. (Ed.). (2013). *Health Literacy: Improving Health, Health Systems, and Health Policy Around the World: Workshop Summary*. National Academies Press.

Hickman, L. A. (2001). *Philosophical tools for technological culture*. Bloomington, IN: Indiana University Press.

Hieftje, K., Duncan, L. R., & Fiellin, L. E. (2014). Novel methods to collect meaningful data from adolescents for the development of health interventions. *Health promotion practice*, *15*(5), 714-722.

Hill, G. W. (1982). Group versus individual performance: Are N+ 1 heads better than one?. *Psychological bulletin*, *91*(3), 517.

Hill, L. H. (2004). Health literacy is a social justice issue that affects us all. *Adult Learning*, *15*(1-2), 4.

Hillebrand, B., Kok, R. A., & Biemans, W. G. (2001). Theory-testing using case studies: a comment on Johnston, Leach, and Liu. *Industrial Marketing Management*, *30*(8), 651-657.

Hoffman, L. H., & Thomson, T. L. (2009). The effect of television viewing on adolescents' civic participation: Political efficacy as a mediating mechanism. *Journal of Broadcasting & Electronic Media*, *53*(1), 3-21.

Hooghe, M., & Dassonneville, R. (2011). The effects of civic education on political knowledge. A two year panel survey among Belgian adolescents. *Educational Assessment, Evaluation and Accountability*, *23*(4), 321-339.

Horner, R. H., Swaminathan, H., Sugai, G., & Smolkowski, K. (2012). Considerations for the systematic analysis and use of single-case research. *Education and Treatment of Children*, *35*(2), 269-290.

Howse, R. B., Best, D. L., & Stone, E. R. (2003). Children's decision making: The effects of training, reinforcement, and memory aids. *Cognitive Development*, *18*(2), 247-268.

Huang, T.-C., & Chen, C.-C. (2013). Animating Civic Education: Developing a Knowledge Navigation System using Blogging and Topic Map Technology. *Educational Technology & Society*, 16 (1), 79–92.

Hummel, H. G., Paas, F., & Koper, E. J. R. (2006). Timing of cueing in complex problem-solving tasks: Learner versus system control. *Computers in Human Behavior*, *22*(2), 191-205.

Institute of Medicine. (2004). Health literacy: A prescription to end confusion. Washington, DC: National Academies Press. Retrieved from http://www.nap.edu/catalog.php?record_id=10883#toc at 06 July 2016.

Ioannou, S., Kouta, C., Constantinidou, M., & Ellina, P. (2014). Sexuality education as a collective responsibility: a new health education curriculum in Cyprus. *Sex Education*, *14*(4), 375-386.

Isin, E. F., & Wood, P. K. (1999). *Citizenship and identity* (Vol. 448). Sage.

Ito, M., Baumer, S., Bittanti, M., Boyd, D., Cody, R., Herr-Stephenson, et al. (2009). *Hanging out, messing around and geeking out: Living and learning with new media*. Cambridge, MA: MIT Press.

Janssen, J., Berlanga, A. J., & Koper, R. (2011). Evaluation of the Learning Path Specification. *Educational Technology & Society*, 14(3), 218-230.

Jenkins, H., Clinton, K., Purushotma, R., Robison, A. J., & Weigel, M. (2007). *Confronting the challenges of participatory culture: Media education for the 21st century*. Cambridge, MA: MIT Press.

Jensen, J. L., & Rodgers, R. (2001). Cumulating the intellectual gold of case study research. *Public Administration Review*, 61(2), 235-246.

Jiménez-Aleixandre, M. P., & Pereiro-Muñoz, C. (2005). Argument construction and change while working on a real environment problem. In *Research and the quality of science education* (pp. 419-431). Springer Netherlands.

Johansson, R. (2003). Case study methodology. *Methodologies in Housing Research, Stockholm*.

Joosten, T. (2010). Mobile learning and social media: Increasing engagement and interactivity. Paper presented at the New Media Consortium Conference, June 9-12, 2010, Anaheim, CA.

Joseph, D. (2004).The Practice of Design-Based Research: Uncovering the Interplay between Design, Research, and the Real-World Context. *Educational Psychologist*, 39(4), 235–242.

Kahne, J. (2008). *The civic potential of video games*. MIT Press.

Kahne, J., Lee, N. J., & Feezell, J. T. (2013). The civic and political significance of online participatory cultures among youth transitioning to adulthood. *Journal of Information Technology & Politics*, *10*(1), 1-20.

Kapp, K. M. (2012). Games, gamification, and the quest for learner engagement. *T+ D*, *66*(6), 64-68.

Kato, P. M. (2010). Video games in health care: Closing the gap. *Review of General Psychology*, *14*(2), 113.

Ke, F. (2009). A qualitative meta-analysis of computer games as learning tools. *Handbook of research on effective electronic gaming in education, 1*, 1-32.

Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. *Research in learning technology, 20.*

Keegan, D. (2002). *The future of learning: From eLearning to mLearning, ZIFF papiere 119*. Retrieved from ERIC ED472435 database. Available at http://www.fernuni-hagen.de/ZIFF

Kedrayate, A. (2012). Non-formal education: Is it relevant or obsolete. *International Journal of Business, Humanities and Technology*, *2*(4), 1-5.

Kerr, D. (1999). Citizenship education in the curriculum: An international review. *School Field, 10*(3/4), 5-32.

Kerr, N. L., & Tindale, R. S. (2004). Group performance and decision making. *Annu. Rev. Psychol., 55*, 623-655.

Kickbusch, I. (2004). The Leavell lecture 1-The end of public health as we know it: constructing global public health in the 21st century. *Global Health Promotion, 11*(4), 206.

Kiger, D., Herro, D., & Prunty, D. (2012). Examining the influence of a mobile learning intervention on third grade math achievement. *Journal of Research on Technology in Education*, *45*(1), 61-82.

Kim, S. H., Mims, C., & Holmes, K. P. (2006). An introduction to current trends and benefits of mobile wireless technology use in higher education. *AACE journal*, *14*(1), 77-100.

King, M., Lapsley, I., Mitchell, F., & Moyes, J. (1994). *Activity based costing in hospitals: a case study investigation*. Cima.

Kirriemuir, J. & McFarlane, A. (2004). *Literature review in games and learning.* Report 8. Bristol. Nesta Futurelab.

Kirk, J., & Miller, M. L. (1986). *Reliability and validity in qualitative research*. Sage.

Kolb, L. (2011). Adventures with cell phones. *Educational Leadership,* 68(5), 39.

Komalasari, K. (2009). The effect of contextual learning in civic education on students' civic competence. *Journal of social sciences*, *5*(4), 261.

Koole, M. L. (2009). A model for framing mobile learning. *Mobile learning: Transforming the delivery of education and training*, *1*(2), 25-47.

Koster, R. (2005). *A theory of fun for game design*. Scottsdale, AZ: Paraglyph Press.

Koutromanos G. and Avraamidou L. (2014). The use of mobile videogames in formal and informal learning environments: a review of the literature. *Educational Media International*, 54 (1),49-65.

Krueger, R. A., & Casey, M. A. (2000). *Focus groups: A Practical Guide for Applied Research (3rd edition).* Thousand Oaks, Calif.: Sage.

Krumina, A. A., & Lubenko, J. (2016). Web-Based Intervention for Developing Long-Term Health Literacy of Individuals: Possibilities and Limitations. *Journal of Teacher Education for Sustainability*, *18*(1), 69.

Kukulska-Hulme, A., & Traxler, J. (2005). Mobile teaching and learning. *Mobile learning-a handbook for educators and trainers*, 25-44.

Kutner, M., Greenberg, E., Jin, Y., & Paulsen, C. (2006). US Department of Education. *Washington, DC: National Center for Education Statistics*, 2006-483.

Laird, T., Shoup, R., Kuh, G., & Schwarz, M. (2008). The effects of discipline on deep approaches to student learning and college outcomes. *Research in Higher Education*, 49,469–494.

Lankshear, C., & Knobel, M. (2011). *New Literacies: Everyday Practices And Social Learning: Everyday Practices and Social Learning*. McGraw-Hill International.

Latchem, C. R. (2014). Informal learning and non-formal education for development. *Journal of Learning for Development-JL4D*, *1*(1).

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge university press.

Lawy, R., & Biesta, G. (2006). Citizenship-as-practice: The educational implications of an inclusive and relational understanding of citizenship. *British Journal of Educational Studies, 54*(1), 34-50.

Lenhart, A., Kahne, J., Middaugh, E., Macgill, A. R., Evans, C., & Vitak, J. (2008). Teens, Video Games, and Civics: Teens' Gaming Experiences Are Diverse and Include Significant Social Interaction and Civic Engagement. *Pew Internet & American Life Project*.

Leonard-Barton, D. (1990). A dual methodology for case studies: Synergistic use of a longitudinal single site with replicated multiple sites. *Organization science, 1*(3), 248-266.

Lesta, S., Lazarus, J. V., & Essén, B. (2008). Young Cypriots on sex education: sources and adequacy of information received on sexuality issues. *Sex Education*, *8*(2), 237-246.

Linehan, C., Lawson, S., Doughty, M., & Kirman, B. (2009). There's no 'I' in 'Emergency Management Team:' Designing and evaluating a serious game for training emergency managers in group decision making skills. In *Proceedings of the 39th Conference of the Society for the Advancement of Games & Simulations in Education and Training* (pp. 20-27). Innovation North-Leeds Metropolitan University.

Looi, C. K., Seow, P., Zhang, B., So, H. J., Chen, W., & Wong, L. H. (2010). Leveraging mobile technology for sustainable seamless learning: a research agenda. *British Journal of Educational Technology*, *41*(2), 154-169.

Lubbe, S. (2003). Development of a case study methodology in the information technology (IT) field in South Africa: a step-by-step approach. *SA Journal of Information Management*, *5*(4).

Luckin, R. (2010). *Re-designing learning contexts: Technology-rich, learner-centred ecologies*. Routledge.

Lund, J. (1992). Assessment and accountability in secondary physical education. *Quest*, *44*(3), 352-360.

Martin, S., Diaz, G., Sancristobal, E., Gil, R., Castro, M., & Peire, J. (2011). New technology trends in education: Seven years of forecasts and convergence. *Computers & Education*, *57*(3), 1893-1906.

Marton, F., & Säljö, R. (1976). On Qualitative Differences in Learning: I-Outcome and process. *British journal of educational psychology*, *46*(1), 4-11.

Mason, J. (2002) *Qualitative Researching*, SAGE Publications Ltd, London.

Mayer, R. E., & Johnson, C. I. (2010). Adding instructional features that promote learning in a game-like environment. *Journal of Educational Computing Research*, *42*(3), 241-265.

McBride, R. E., & Xiang, P. (2004). Thoughtful Decision Making in Physical Education: A Modest Proposal. *Quest*, *56*(3), 337-354.

McCallum, S. (2012). Gamification and serious games for personalized health. *Stud Health Technol Inform*, *177*, 85-96.

McFarlane, A., Sparrowhawk, A., & Heald, Y. (2002). *Report on the educational use of games*. TEEM (Teachers evaluating educational multimedia), Cambridge.

McGonigal, J. (2011). *Reality Is Broken: Why Games Make Us Better and How They Can Change the World.* London: Penguin.

McKenney, S., & Reeves, T. C. (2013). *Conducting educational design research*. Routledge.

McLeod, J. M. (2000). Media and civic socialization of youth. *Journal of Adolescent Health*, *27*(2), 45-51.

Merriam, S. B. (2009). Qualitative Research: a guide to design and interpretation. *San Francisco: Jossey-Bass*.

Merriam, S. B. (1998). *Qualitative research and case study applications in education. Revised and expanded from*. Jossey-Bass Publishers, 350 Sansome St, San Francisco, CA 94104.

Meyer, C. B. (2001). A case in case study methodology. *Field methods,13*(4), 329-352.

Miller, A. D., Pater, J., & Mynatt, E. D. (2013, May). Design strategies for youth-focused pervasive social health games. In *2013 7th International Conference*

Miles, R. (2015). Complexity, representation and practice: Case study as method and methodology. *Issues in Educational Research, 25*(3), 309-318.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.

Mishra, R. K. (2014). Social constructivism and teaching of social science. *Journal of Social Studies Education Research*, *5*(2).

Mogford, E., Gould, L., & Devoght, A. (2010). Teaching critical health literacy as a means to action on the social determinants of health. *Health promotion international*, daq049.

Montgomery, K., Gottlieb-Robles, B., & Larson, G. O. (2004). *Youth as e-citizens: Engaging the digital generation.* Washington DC: Center for Social Media School of Communication, American University.

Montanaro, E., Fiellin, L. E., Fakhouri, T., Kyriakides, T. C., & Duncan, L. R. (2015). Using videogame apps to assess gains in adolescents' substance use knowledge: new opportunities for evaluating intervention exposure and content mastery. *Journal of medical Internet research*, *17*(10).

Moreno-Ger, P., Burgos, D., Martínez-Ortiz, I., Sierra, J. L., & Fernández-Manjón, B. (2008). Educational game design for online education. *Computers in Human Behavior*, *24*(6), 2530-2540.

Muntean, C. I. (2011, October). Raising engagement in e-learning through gamification. In *Proc. 6th International Conference on Virtual Learning ICVL* (pp. 323-329).

Murray, O. T., & Olcese, N. R. (2011). Teaching and learning with iPads, ready or not? *TechTrends*, *55*(6), 42-48.

Naismith, L., Lonsdale, P., Vavoula, G. N., & Sharples, M. (2004). Mobile technologies and learning.

Newman, D. (1990). Opportunities for research on the organizational impact of school computers. *Educational Researcher*, *19*(3), 8-13.

Nicolaou, C. T., Korfiatis, K., Evagorou, M., & Constantinou, C. (2009). Development of decision-making skills and environmental concern through computer-based, scaffolded learning activities. *Environmental Education Research*, *15*(1), 39-54.

Nie, N. H., Hillygus, D. S., & Erbring, L. (2002). Internet use, interpersonal relations, and sociability. *The Internet in everyday life*, 215-243.

Noor, K. B. M. (2008). Case study: A strategic research methodology. *American journal of applied sciences*, *5*(11), 1602-1604.

North American Alliance for Environmental Education. (2000). The guidelines for the initial preparation of environmental educators. Washington, DC

Norvell, K. H., & Gelmon, S. B. (2011). Assessing Civic Engagement. *Promoting Student Engagement*, 265.

Oh, H., Rizo, C., Enkin, M., & Jadad, A. (2005). What is eHealth? A systematic review of published definitions. World Hospitals and Health Services, 41(1), 32–40.

Oliver, M., & Carr, D. (2009). Learning in virtual worlds: Using communities of practice to explain how people learn from play. *British Journal of Educational Technology*, *40*(3), 444-457.

Olson, C. K. (2010). Children's motivations for video game play in the context of normal development. *Review of General Psychology*, *14*(2), 180.

O'Neil, H. F., Wainess, R., & Baker, E. L. (2005). Classification of learning outcomes: Evidence from the computer games literature. *The Curriculum Journal*, *16*(4), 455-474.

O'Toole, T., Lister, M., Marsh, D., Jones, S., & McDonagh, A. (2003). Tuning out or left out? Participation and non-participation among young people. *Contemporary politics*, *9*(1), 45-61.

Paechter, C. (2000) Changing school subjects: Power, gender and curriculum. Buckingham: Open University Press.

Page, S. E. (2008). *The difference: How the power of diversity creates better groups, firms, schools, and societies*. Princeton University Press.

Park, Y. (2011). A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types. *The International Review of Research in Open and Distributed Learning*, *12*(2), 78-102.

Pasek, J., Feldman, L., Romer, D., & Jamieson, K. H. (2008). Schools as incubators of democratic participation: Building long-term political efficacy with civic education. *Applied Development Science*, *12*(1), 26-37.

Patrick, J. J. (1995). Civic Education for Constitutional Democracy: An International Perspective. ERIC Digest.

Patton, M. (2002). *Qualitative research & evaluation methods (3rd ed.)*. London, UK: Sage.

Peters, K. (2007). m-Learning: Positioning educators for a mobile, connected future. *International Journal Of Research in Open and Distance Learning, 8*(2), 1-17.

Pettigrew, A. M. (1990). Longitudinal field research on change: Theory and practice. *Organization science*, *1*(3), 267-292.

Perkins, D. (1999). The many faces of constructivism. *Educational leadership, 57*(3), 6-11.

Pivec, M., Dziabenko, O., & Schinnerl, I. (2003, July). Aspects of game-based learning. In *3rd International Conference on Knowledge Management, Graz, Austria* (pp. 216-225).

Play2Prevent Lab (2013). *PlayForward: Elm City Stories* [iPad game]. New Haven, CT: Play2Prevent Lab.

Powell, K. C., & Kalina, C. J. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education, 130*(2), 241.

Prensky, M. (2001). *Digital game based learning*. New York: McGraw-Hill.

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, *14*(2), 154-166.

Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. Simon and Schuster.

Quinn, C. (2000). mLearning: Mobile, wireless, in-your-pocket learning. *LiNE Zine, 2006*.

Raphael, C., Bachen, C., Lynn, K. M., Baldwin-Philippi, J., & McKee, K. A. (2010). Games for civic learning: A conceptual framework and agenda for research and design. *Games and Culture*, *5*(2), 199-235.

Ray, B., Caroline Faure EDD, A. T. C., & Kelle, F. (2013). Using social impact games (SIGS) to support constructivist learning: Creating a foundation for effective use in the secondary social studies education. *American Secondary Education, 41*(2), 60.

Redecker, C., Ala-Mutka, K., Bacigalupo, M., Ferrari, A., & Punie, Y. (2009). Learning 2.0: The impact of Web 2.0 innovations on education and training in Europe. *Final Report. European Commission-Joint Research Center-Institute for Prospective Technological Studies, Seville*.

Reeves,T. (2006). Design Research from a Technology Perspective. In J. van den Akker, K. Gravemeijer, S. McKenny, & N. Mieveen, (Eds.), *Educational design research* (pp. 86–109). London: Routledge.

Reeves, T. C., McKenney, S., & Herrington, J. (2011). Publishing and perishing: The critical importance of educational design research. *Australasian Journal of Educational Technology*, *27*(1), 55-65.

Reigeluth, C.M., & Frick, T.W. (1999). Formative research: A methodology for creating and improving design theories. In C. M. Reigeluth (Ed.), *Instructional- Design Theories and Models* (Vol.I I, p p. 633-651). Mahwah, NJ: Lawrence Erlbaum.

Rice, J. W. (2007). New media resistance: Barriers to implementation of computer video games in the classroom. *Journal of Educational Multimedia and Hypermedia*, *16*(3), 249-261.

Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational technology research and development*, *44*(2), 43-58.

Robertson, J., & Howells, C. (2008). Computer game design: Opportunities for successful learning. *Computers & Education*, *50*(2), 559-578.

Russell, C., Gregory, D., Ploeg, J., DiCenso, A., & Guyatt, G. (2005). Qualitative research. In A. DiCenso, G. Guyatt, & D. Ciliska (Eds.), *Evidence-based nursing: A guide to clinical practice* (pp. 120-135). St. Louis, MO: Elsevier Mosby.

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and emotion*, *30*(4), 344-360.

Sadler, T. D., & Donnelly, L. A. (2006). Socioscientific argumentation: The effects of content knowledge and morality. *International Journal of Science Education*, *28*(12), 1463-1488.

Salen, K. (Ed.). (2008). *The ecology of games: Connecting youth, games, and learning*. MIT Press.

Sandberg, J., Maris, M., & de Geus, K. (2011). Mobile English learning: An evidence-based study with fifth graders. *Computers & Education*, *57*(1), 1334-1347.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students (5th ed)*. Harlow: Financial Times Prentice Hall.

Schell, C. (1992). The value of the case study as a research strategy. *Manchester Business School*, *2*.

Schoenfeld, A. H. (1992). On paradigms and methods: What do you do when the ones you know don't do what you want them to? Issues in the analysis of data in the form of videotapes. *The Journal of the Learning Sciences*, *2*(2), 179-214.

Schudson, M. (1998). *The good citizen: A history of American civic life*. New York: Martin Kessler Books.

Schugurensky, D., & Myers, J. P. (2008). Informal Civic Learning Through Engagement in Local Democracy: The Case of the Seniors' Task Force of Healthy City Toronto. In *Learning through Community* (pp. 73-95). Springer Netherlands.

Schuck, S., Aubusson, P., Kearney, M., & Burden, K. (2013). Mobilising teacher education: A study of a professional learning community. *Teacher Development*, *17*(1), 1-18.

Schwartz, D. L., Lin, X., Brophy, S., & Bransford J, .D. (1999). Toward the development of flexibility adaptive instructional designs. In C. M. Reigeluth (Ed.), *Instructional-design theories and models (Vol. II, pp. 183-213)*. Mahwah, NJ: Lawrence Erlbaum.

Selwyn, N. (2007, October). Web 2.0 applications as alternative environments for informal learning - a critical review. In *Paper for CERI-KERIS International Expert Meeting on ICT and Educational Performance* (pp. 16-17).

Simões, J., Redondo, R. D., & Vilas, A. F. (2013). A social gamification framework for a K-6 learning platform. *Computers in Human Behavior*, *29*(2), 345-353.

Sins, P. H., van Joolingen, W. R., Savelsbergh, E. R., & van Hout-Wolters, B. (2008). Motivation and performance within a collaborative computer-based modeling task: Relations between students' achievement goal orientation, self-efficacy, cognitive processing, and achievement. *Contemporary Educational Psychology*, *33*(1), 58-77.

Sharples, M. (2006). Big issues in mobile learning. In *Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative*. Nottingham: LSRI, University of Nottingham.

Sharples, M., Corlett, D., & Westmancott, O. (2002). The design and implementation of a mobile learning resource. *Personal and Ubiquitous computing*, *6*(3), 220-234.

Shenton, A.K. (2004) "Strategies for Ensuring Trustworthiness in Qualitative Research Projects", *Education for Information*, Vol. 22, No. 2, pp 63-75

Sherry, J. L., Lucas, K., Greenberg, B. S., & Lachlan, K. (2006). Video game uses and gratifications as predictors of use and game preference. *Playing video games: Motives, responses, and consequences*, 213-224.

Shin, N., Norris, C., & Soloway, E. (2011). Mobile Gaming Environment.

Schunk, D. H. (2011). Learning theories: An educational perspective: Pearson Education Canada.

Sicart, M. (2008). Defining game mechanics. *Game Studies*, *8*(2), 1-14.

Simons, H. (2009). *Case study research in practice*. SAGE publications.

Simovska, V. (2007). The changing meanings of participation in school-based health education and health promotion: the participants' voices. *Health Education Research*, *22*(6), 864-878.

Sitzmann, T. (2011). A meta-analytic examination of the instructional effectiveness of computer-based simulation games. *Personnel psychology*, *64*(2), 489-528.

Skon, L., Johnson, D. W., & Johnson, R. T. (1981). Cooperative peer interaction versus individual competition and individualistic efforts: Effects on the acquisition of cognitive reasoning strategies. *Journal of Educational Psychology*, *73*(1), 83.

Smith, N., Lister, R., Middleton, S., & Cox, L. (2005). Young People as Real Citizens: Towards an Inclusionary Understanding of Citizenship The paper is based on the project 'Negotiating Transitions to Citizenship'(L134 25 1039), funded by the Economic and Social Research Council as part of the 'Youth, Citizenship and Social Change' programme. *Journal of youth studies*, *8*(4), 425-443.

Spence, K. K., Hess, D. G., McDonald, M., & Sheehan, B. J. (2009). Designing experiential learning curricula to develop future sport leaders. *Sport Management Education Journal*, *3*(1), 1-25.

Spiro, R.J., Feltovich, P.J., Jacobson, M. J., & Coulson, R.L. (1991, May). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. *Educational Technology*, 31 (5), 24-33.

Squire, K. (2006). From content to context: Videogames as designed experience. *Educational researcher*, *35*(8), 19-29.

Stake, R. E. (1995). The art of case study research. Thousand Oaks, CA: Sage.

Stake, R. E. (2011). *Qualitative research: Studying how things work*. New York, NY: The Guilford Press.

Steinkuehler, C. A. (2004, June). Learning in massively multiplayer online games. In *Proceedings of the 6th international conference on Learning sciences* (pp. 521-528). International Society of the Learning Sciences.

Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of Educational Research*, *79*(2), 625-649.

Stokes, B. (2012). Restructuring civic engagement: Meaningful choice and game design thinking. In A. Delwiche & J. J. Henderson (Eds.), *The Participatory Cultures Handbook*. Routledge.

Stott, A., & Neustaedter, C. (2013). *Analysis of Gamification in Education*. Technical Report 2013-0422-01, Connections Lab, Simon Fraser University, Surrey, BC, Canada, April, 8 pgs.

Strack, R. W., Magill, C., & McDonagh, K. (2004). Engaging youth through photovoice. *Health promotion practice*, *5*(1), 49-58.

Su, C. H., & Cheng, C. H. (2013). A mobile videogame-based insect learning system for improving the learning achievements. *Procedia-Social and Behavioral Sciences*, *103*, 42-50.

Supovitz, J. A., & Tognatta, N. (2013). The impact of distributed leadership on collaborative team decision making. *Leadership and Policy in Schools*, *12*(2), 101-121.

Sykes, W. 1990. Validity and reliability in qualitative market research: A review of the literature. *Journal of the Market Research Society* 32 (3): 289–328

Tellis, W. M. (1997). Application of a case study methodology. *The qualitative report*, *3*(3), 1-19.

The Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 5-8.

Thinking, G. D. (2012). RESTRUCTURING CIVIC ENGAGEMENT. *The Participatory Cultures Handbook*, 143.

Traxler, J. (2007). Defining, Discussing and Evaluating Mobile Learning: The moving finger writes and having writ.... *The International Review of Research in Open and Distributed Learning*, *8*(2).

Traxler, J. (2009). Current state of mobile learning1. *Mobile learning*, 9.

Turner, A. (1996). Teaching for understanding: Myth or reality? *Journal of Physical Education, Recreation & Dance*, *67*(4), 46-55.

Tutty, J. I., & Klein, J. D. (2008). Computer-mediated instruction: A comparison of online and face-to-face collaboration. *Educational Technology Research and Development*, *56*(2), 101-124.

Tüzün, H., Yılmaz-Soylu, M., Karakuş, T., İnal, Y., & Kızılkaya, G. (2009). The effects of computer games on primary school students' achievement and motivation in geography learning. *Computers & Education*, *52*(1), 68-77.

U.S. Department of Health and Human Services. (2000). *Healthy People 2010*. Washington, DC: U.S. Government Printing Office.

Van den Akker, J., Gravemeijer, K., McKenney, S., & Nieveen, N. (Eds.). (2006). *Educational design research*. Routledge.

van Joolingen, W. R., de Jong, T., Lazonder, A. W., Savelsbergh, E. R., & Manlove, S. (2005). Co-Lab: research and development of an online learning environment for collaborative scientific discovery learning. *Computers in human behavior*, *21*(4), 671-688.

Van Maanen, John. (1988). *Tales of the Field: On writing ethnography*. Chicago: University Press

Veermans, M., & Cesareni, D. (2005). The nature of the discourse in web-based collaborative learning environments: Case studies from four different countries. *Computers & Education*, 45, 316–336.

Vissak, T. (2010). Recommendations for using the case study method in international business research. *The Qualitative Report*, *15*(2), 370.

Vrasidas, C. (2001). Interpretivism and Symbolic Interactionism: "Making the Familiar Strange and Interesting Again" in Educational Technology Research. In Heinecke, W., & Willis, J. (Eds.),

Research Methods in Educational Technology (pp. 81-99). Greenwich, CT: Information Age Publishing, Inc.

Vrasidas, C. (2014). *Eisagogi stin Poiotiki Ereuna (Introduction to Qualitative Research).* Nicosia: CARDET Press.

Vrasidas, C., & Solomou, M. (2013). Using educational design research methods to examine the affordances of online games for teacher learning. *Educational Media International*, *50*(3), 192-205.

Vrasidas, C., Zembylas, M., and Petrou, A. (2005). Contemporary learning theories and educational technologies, in Retalis, S. (ed.). *Technology and learning*. Athens, Greece: Kastanioti Editions, pp.35-58 (in Greek).

Vrasidas C., Zembylas M., Themistokleous S., Pattis R., Kokkalou C., Hadjisofoclis D. (2013). *Research Report on Citizens' Political Disengagement in Cyprus.* Brussels: Centre for European Studies.

Vos, N., van der Meijden, H., & Denessen, E. (2011). Effects of constructing versus playing an educational game on student motivation and deep learning strategy use. *Computers & Education*, *56*(1), 127-137.

Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Harvard university press.

Vygotsky, L. S. (1986). Thought and language (rev. ed.).

Walker, K. (2006). Introduction: Mapping the landscape of mobile learning. In M. Sharples (Ed.), *Big issues in mobile learning: Report of a workshop by the kaleidoscope network of excellence mobile learning initiative*. University of Nottingham.

Wang, F. & Hannafin, M. J. (2005). Design-Based Research and Technology-Enhanced Learning Environments. *Educational Technology Research and Development*, 53(4), 5-23.

Weber, R. P. (1990). *Basic content analysis*. Beverly Hills, CA: Sage.

Westheimer, J., & Kahne, J. (2004). What kind of citizen? The politics of educating for democracy. *American educational research journal*, *41*(2), 237-269.

Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American educational research journal*, *39*(1), 165-205.

Whitton, N., & Hollins, P. (2008). Collaborative virtual gaming worlds in higher education. *Research in learning technology*, *16*(3).

Wilson, K. A., Bedwell, W. L., Lazzara, E. H., Salas, E., Burke, C. S., Estock, J. L., & Conkey, C. (2009). Relationships between game attributes and learning outcomes review and research proposals. *Simulation & Gaming*, *40*(2), 217-266.

Whitton, N. (2011). Game Engagement Theory and Adult Learning. *Simulation & Gaming*, 42(5), 596-609.

World Health Organization. Health literacy and health behaviour; 2013 [cited 2016 July 16]. Available at: http://www.who.int/healthpromotion/conferences/7gchp/track2/en/.

World Health Organization Regional Office for Europe/BZgA (WHO; 2010). Standards for Sexuality Education in Europe. Federal Centre for Health Education (BZgA): Cologne

Wouters, P., Van Nimwegen, C., Van Oostendorp, H., & Van Der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, *105*(2), 249.

Xie, B. (2011). Older adults, e-health literacy, and collaborative learning: An experimental study. *Journal of the American Society for Information Science and Technology*, *62*(5), 933-946.

Xie, B., & Jaeger, P.T. (2008). Computer training programs for older adults at the public library. *Public Libraries*, 47(5), 42–49. Xhafa, F., Fernandez, R., Daradoumis, T., Barolli, L., & Caballé, S. (2007). Improvement of JXTA protocols for supporting reliable distributed applications in P2P systems. *Network-Based Information Systems*, 345-354.

Yin, R. K. (1989). Case study research: Design and methods, revised edition. *Applied Social Research Methods Series*, *5*.

Yin, R. K. (1989). Research design issues in using the case study method to study management information systems. *The information systems research challenge: Qualitative research methods*, *1*, 1-6.

Yin, R. K. (1993). Applications of case study research. Applied social research methods series. *London and New Delhi: Sage Publications*.

Yin, R. (1994). Case study research: Design and methods. Beverly Hills.

Yin, R. K.(2003). Case study research: Design and methods. *Sage Publications, Inc*, *5*, 11.

Yoders, S. (2014). Constructivism Theory and Use from 21st Century Perspective. *Journal of Applied Learning Technology*, *4*(3).

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, (9), 1-6.

8. Annexes

8. 1. Annex A: Post Implementation Interview Protocol

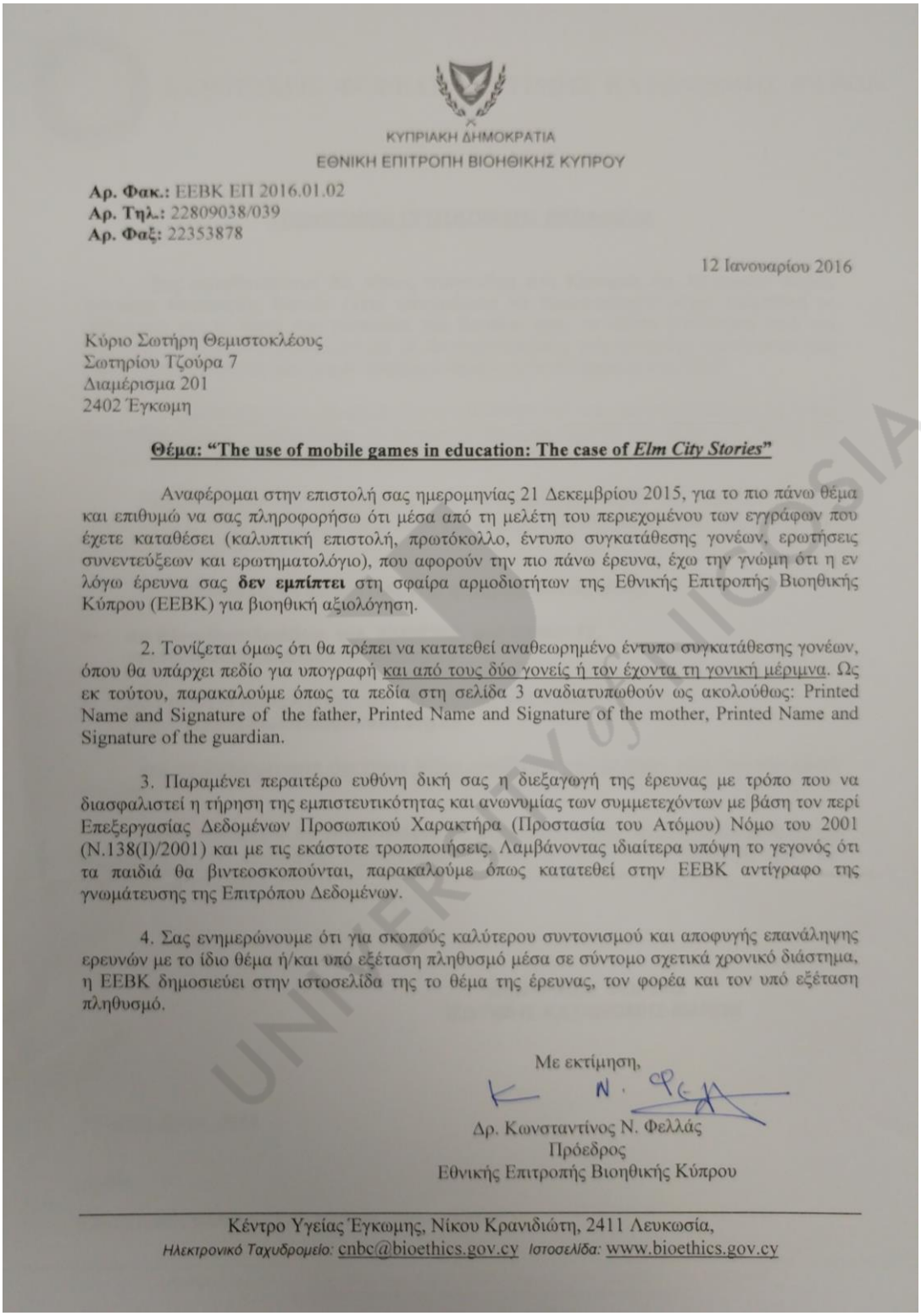
The Use of Mobile videogames in Education: The Case of *Elm City Stories*

Post-Game Implementation Interviews

1. How would you describe the experience of playing this game?
2. What have you learned? Can you summarize it in a few sentences?
3. Have you learned things that you think you will apply to your everyday life? Can you give several examples?
4. What kind of skills do you think you deploy playing the game? (i.e., decision-making, critical thinking, planning, visioning, collaborating, communicating)
5. Did you have any difficulties when playing the game?
6. How would you compare this game with other games that you usually play? Can you point out similarities and/or differences?
7. What did you enjoy and what didn't you enjoy about this game? Feel free to comment on both its content and design/graphics.
8. Did you enjoy playing the game with a partner or would you have preferred you played alone? Why?
9. How different would your game experience be if you would play the game alone? Please explain.

10. Now I want you to talk to me about decision-making, which was a major part of the game. But, first of all, what is your definition of decision-making? What does it mean to make a decision? Can you give me an example?
11. Have you ever been taught decision-making in any other context before?
12. Where did you see instances of decision-making in the game? Give me an example.
13. How were you making a decision in your group? Give me an example.
14. What was usually your role in this process?
15. How important do you think is decision-making skill for everyday life? Can you give me an example?
16. Do you think that the game helped you develop these skills? Yes or no, explain why.

8.2. Annex B: Cyprus Bioethics Committee Approval



ΚΥΠΡΙΑΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΕΘΝΙΚΗ ΕΠΙΤΡΟΠΗ ΒΙΟΗΘΙΚΗΣ ΚΥΠΡΟΥ

Αρ. Φακ.: ΕΕΒΚ ΕΠ 2016.01.02
Αρ. Τηλ.: 22809038/039
Αρ. Φαξ: 22353878

12 Ιανουαρίου 2016

Κύριο Σωτήρη Θεμιστοκλέους
Σωτηρίου Τζούρα 7
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2402 Έγκωμη

Θέμα: "The use of mobile games in education: The case of *Elm City Stories*"

Αναφέρομαι στην επιστολή σας ημερομηνίας 21 Δεκεμβρίου 2015, για το πιο πάνω θέμα και επιθυμώ να σας πληροφορήσω ότι μέσα από τη μελέτη του περιεχομένου των εγγράφων που έχετε καταθέσει (καλυπτική επιστολή, πρωτόκολλο, έντυπο συγκατάθεσης γονέων, ερωτήσεις συνεντεύξεων και ερωτηματολόγιο), που αφορούν την πιο πάνω έρευνα, έχω την γνώμη ότι η εν λόγω έρευνα σας **δεν εμπίπτει** στη σφαίρα αρμοδιοτήτων της Εθνικής Επιτροπής Βιοηθικής Κύπρου (ΕΕΒΚ) για βιοηθική αξιολόγηση.

2. Τονίζεται όμως ότι θα πρέπει να κατατεθεί αναθεωρημένο έντυπο συγκατάθεσης γονέων, όπου θα υπάρχει πεδίο για υπογραφή και από τους δύο γονείς ή τον έχοντα τη γονική μέριμνα. Ως εκ τούτου, παρακαλούμε όπως τα πεδία στη σελίδα 3 αναδιατυπωθούν ως ακολούθως: Printed Name and Signature of the father, Printed Name and Signature of the mother, Printed Name and Signature of the guardian.

3. Παραμένει περαιτέρω ευθύνη δική σας η διεξαγωγή της έρευνας με τρόπο που να διασφαλιστεί η τήρηση της εμπιστευτικότητας και ανωνυμίας των συμμετεχόντων με βάση τον περί Επεξεργασίας Δεδομένων Προσωπικού Χαρακτήρα (Προστασία του Ατόμου) Νόμο του 2001 (Ν.138(Ι)/2001) και με τις εκάστοτε τροποποιήσεις. Λαμβάνοντας ιδιαίτερα υπόψη το γεγονός ότι τα παιδιά θα βιντεοσκοπούνται, παρακαλούμε όπως κατατεθεί στην ΕΕΒΚ αντίγραφο της γνωμάτευσης της Επιτρόπου Δεδομένων.

4. Σας ενημερώνουμε ότι για σκοπούς καλύτερου συντονισμού και αποφυγής επανάληψης ερευνών με το ίδιο θέμα ή/και υπό εξέταση πληθυσμό μέσα σε σύντομο σχετικά χρονικό διάστημα, η ΕΕΒΚ δημοσιεύει στην ιστοσελίδα της το θέμα της έρευνας, τον φορέα και τον υπό εξέταση πληθυσμό.

Με εκτίμηση,

Δρ. Κωνσταντίνος Ν. Φελλάς
Πρόεδρος
Εθνικής Επιτροπής Βιοηθικής Κύπρου

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8.3. Annex C: Parental Consent Form

Parental Consent for non-Adult Participation in Education Research

Research Title: "The Use of Mobile videogames in Education: The Case of *Elm City Stories*"

The aim of the research project

The purpose of the research is to examine the ways in which video games can be employed in education. Specifically, this project aims to examine the use of an online game (Elm City Stories http://www.play2prevent.org/) developed at Yale University in the US, for supporting students in making informed decisions about their lives related to health and risk reduction.

PlayForward: Elm City Stories

PlayForward serves as the foundation for the play2PREVENT Lab (http://www.play2prevent.org/) and is funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development in the United States. The project's goal is to develop and evaluate an interactive videogame designed to provide young teens with the opportunity to acquire and practice skills for smoking and drinking prevention, and learn about the risk reduction of health issues (e.g., HIV prevention). This videogame incorporates evidence-based concepts from prominent behavior change theories, including self-efficacy, social norms, message framing, and delay discounting. PlayForward is an interactive world in which the player, using an Avatar (virtual character) they have created, "travels" through life, facing challenges and making decisions that create different risks and benefits. Players have the ability to see how their choices affect their lives and subsequently, are able to move back in time to see how different actions might have led to different outcomes. By negotiating challenges in a highly-repetitive and meaningful way, players learn skills that translate to real-life, equipping them to avoid situations that increase the risk of smoking and alcohol use, and other

possible negative health outcomes. Data generated from the game allows us to track players' actions. Using these data we can evaluate in real time how our players acquire skills to help them make better choices about health promotion and reducing risky behavior.

What procedures are involved? If you agree that your child can participate in this research, she/he will be asked to:

- Complete a questionnaire regarding her/his views, experiences and habits of playing mobile videogames in her/his everyday life. The completion of the questionnaire will take no more than 25 minutes and will be done in the presence of the researchers during a scheduled session
- Play the game in groups of 2, twice a week for 1.5 hours, for six weeks, during a supervised session with researchers
- Be video-recorded as a group during interactions and conversations
- Participate in an individual interview and focus group discussion upon completion of the six weeks. The interview and focus group discussion will not last longer than an hour, each, and your child will be asked questions related to her/his experiences of playing the game

What are the potential risks? There are no potential risks involved. Should you wish to opt out of the research you can do so at any point without any consequences.

Are there benefits to taking part in the research? There are direct benefits in participating in this research. Participants may benefit from this study through an increased knowledge regarding their health.

What about privacy and confidentiality? Your child can choose to use her/his real name or a pseudonym as participant in the project, and, all data (i.e., interviews, questionnaire) will be kept confidential. After the research project ends, the audio and video-recorded interviews will be kept locked in a secure drawer or computer, and will be destroyed after 3 years.

Who should I contact if I have questions? The coordinators of the project are:

- Sotiris Themistokleous, PhD student at the University of Nicosia
- Dr. Charalambos Vrasidas, CARDET Director & Professor at the University of Nicosia
- Dr. Lucy Avraamidou, CARDET Senior Researcher & Associate Professor at the University of Nicosia/ University of Groningen
- Dr. Tassos Kyriakides, YALE University

Sotiris Themistokleous will facilitate this project and can be conducted at any point through email at: sotiris.t@cardet.org and/or phone at: 99350874.

Remember: Your child's participation in this research is voluntary. Your and your child's decision to participate will not affect her/his school grades or any other school activities. If you decide that your child will participate, you are free to withdraw your child at any time. You will be given a copy of this form for your information and to keep for your records.

Signature of Subject or Legally Authorized Representative

I have read (or someone has read to me) the above information. I have been given an opportunity to ask questions and they have been answered to my satisfaction. I agree that my child participate in this research as shown by my signed consent below. I have been given a copy of this form.

Consent for Participation in Research

"The Use of Mobile videogames in Education: The Case of *Elm City Stories"*

I consent to my child being interviewed and audio/video-recorded on _____ (DATE) in _____ (PLACE) as part of the "The Use of Mobile videogames in Education: The case of *Elm City Stories"*, and recognize that this project, in whole or in part, might result in the publication of a scientific research paper.

_____ _____

Signature of parent/guardian (1) on behalf of participant Date

_____

Printed Name of parent/guardian (1) Printed Name of participant_____

_____ _____

Signature of the parent/guardian (2) on behalf of participant Date

_____

Printed Name of parent/guardian (2) Printed Name of participant

_____ _____

Signature of Researcher Date