



Covid-19 Survivor: Design and Evaluation of a Game to Improve Students' Experience During Social Isolation

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Abstract. In socio-economic crises, such as the recent Covid-19 pandemic, it is crucial to enhance children's understanding of the new situation and their choices to protect their physical and mental health. In this paper, we discuss the design of a serious choice-driven simulation game, called "Covid-19 Survivor", as a means to empower students' awareness of pandemic risks and consequences through decision making and system analysis. The online game simulates the daily routine of a school student through a system of available choices and consequences to five game fields. We qualitatively evaluated the game in a classroom setting with twenty-six 13 years old students and one IT teacher. The preliminary results demonstrate its potential to influence students' perceptions and knowledge about the pandemic as well as to enhance their decision-making and systems thinking skills.

Keywords: Educational games · Simulation games · Covid-19 · Students' behavior · Qualitative study

1 Introduction

Children and adolescents were highly affected by the changes that Covid-19 pandemic brought to our lives [1]. In cases of social isolation and country lockdown, young people must deal with changes in their daily routines, school dynamics, and social relations, which can directly impact their psychology and mental health [2]. As relevant research has shown they often fail to understand the rationale behind these rapid changes, leading to more stress, worry, or fear. In such situations, it is crucial for the education system to support the empowerment of higher order thinking skills in young students, such as systems thinking, probabilistic thinking, and decision making, that would enable them to make informed decisions in complex situations, reflect on their impact and respond to local and global challenges [3]. However, as education researchers and scientists have

claimed, traditional domain-specific instructional pedagogical approaches and tools may be insufficient for supporting skill development and understanding of complex socio-scientific issues, *i.e.* issues with both societal and scientific aspects [4, 5]. Attempting to address this challenge, we propose using a digital simulation game about life during Covid-19 to enhance students' ability to make informed decisions, protecting their physical and mental.

Thus, in this paper we present the design of the "Covid-19 Survivor" game (<http://etl.ppp.uoa.gr/choico/?covid19survivor>), developed and tested by academics in collaboration with a middle-school teacher, and the preliminary results of a short pilot study with junior high-school students. The game belongs to the genre of choice-driven simulation games [6]. It consists of two game map-like areas (City and Home) in which the player makes choices of action (*e.g.* go to the park) affecting a set of game parameters related to the player's condition (*e.g.* Health, Fun). The designers aim to provide students with a fun way to discover and reflect on the possible risks in their daily routine and realize the importance of balancing physical health, communication, and personal interests during such difficult times. In May 2021, we conducted a pilot study with 26 junior high-school students aiming to investigate a) whether and how students' awareness of Covid-19 and can be enhanced by playing the game and b) what decision-making strategies students develop while playing the game.

2 Theoretical Background

Serious games have long been used in formal and informal education to support knowledge and skill development [4, 7]. Playing a game involves, apart from fun and entertainment elements, the aspect of problem-posing and problem-solving [8]. According to Gee [7], players are engaged in a four stages cycle while playing a serious game: "Probe - Hypothesize - Reprobe - Rethink". Through this mental process, the player forms a hypothesis about a possible pattern, tests it, and reflects on their actions based on the provided feedback. This reflective practice is central to how people deal with and respond to complex situations of the real world. Similarly, Garris, Ahlers, Driskell [9] describe the gaming experience as a repeated cycle involving the three steps of "user judgments, user behavior and system feedback", which also requires the development and application of problem-solving practices such as decision-making, critical thinking, and strategy. This process can be identified more intensively in simulation games since they are based on decision-making and system balancing. These games, *e.g.* "the Sims" series, simulate a complex system of connected variables, relations, and rules which are changing dynamically according to the actions of the player upon the simulation, creating a non-linear game flow [8, 9]. The players have to make informed and thoughtful decisions considering the current game state and the different available choices.

The use of serious games or simulation games in educational settings traditionally focuses on core curricula subjects through content-specific problems [7, 8]. Recently, though, there has been an effort to develop and utilize games to enhance children's understanding of open-ended complex issues that have societal and scientific aspects [10]. Nevertheless, there is still a lack of studies focusing on the pedagogical value of simulation games for increasing student awareness and knowledge related to socio-economic crises like Covid-19.

3 The “Covid-19 Survivor” Game

The “Covid-19 Survivor” is a serious game developed by an academic team collaborating with a secondary school IT teacher with the online game design platform ChoiCo (Choices with Consequences). ChoiCo is an open-source environment developed by the NKUA Educational Technology Lab that allows the creation, play and modification of choice-driven simulation games that deal with systemic socio-scientific issues [6]. The game represents the daily life of a middle-school student during the lockdown period. It has a set of 5 fields, *i.e.* “Covid Risk”, “Money”, “Physical”, “Fun”, and “Social”, which start with specific values and change during the gameplay according to the player’s choices. The game interface consists of two interactive maps, “City” and “Home”, each including a set of pinpoints (e.g. “Supermarket”, “Park”, “Birthday Party”) representing the available choices in that area. By clicking on a pin, the “point information” board informs the player about the possible consequences of this choice on the game fields. If the player selects a choice, it will affect the game fields respectively (Fig. 1). The aim is to survive for as long as possible, balancing these fields and preventing them from crossing specific upper or lower limits hidden to the player. Thus, the best player is the one who will make the most choices without losing. The game ends if “Money” becomes less than 0, the “Covid Risk” greater than 90 or if “Physical”, “Fun”, or “Social” less than 5.

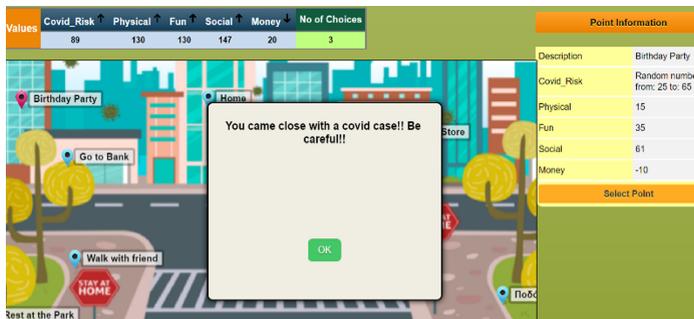


Fig. 1. The player has selected the choice “Birthday Party” which affected the 5 game fields

The gameplay is based on decision-making, prediction, and balance. Every choice has both positive and negative consequences to the game fields, so there is no “ideal” choice to make, but this depends on the current state of the game fields. The consequences values for the field “Covid Risk” were designed according to the official reports of WHO and the National Public Health Organization (NPHO) of Greece. Since risk can have variations, the precise number is picked up randomly between a specific values range. The values for the four other fields are based on literature review and input by a teacher concerning children’s preferences for fun and socializing. The game keeps a history log with the player’s choices and game field values which can be downloaded as a PDF file. The ChoiCo environment also offers a “Design Mode” where end-users can modify main game elements with high-level computational tools, allowing users with

no technical experience, such as teachers, educators or students, to intervene with the game data and create their personalized version.

4 Pilot Evaluation

The pilot study was implemented with 26 junior high-school students (13 females and 13 males) with average age 13 years old and aimed to evaluate whether and how the game enhances their awareness of daily choices during Covid-19 social isolation. Before the study, the participants had experienced a strict national lockdown for four months. The research followed was in alignment with institutional rules and ethics. Before the implementation, the participants answered an online pre-questionnaire with questions about their gaming background and Covid-19 awareness. According to the pre-questionnaires, most participants (73%) enjoyed playing digital games and considered themselves regular players (2–3 times/week). The implementation took place in the school's computer laboratory with the participation of the IT teacher. For 45 min, students played the game online several times downloading the game logs. They were prompted to discuss their choices while playing, allowing the teacher to ask them questions and keep observation notes. After the study, the researchers had a semi-structured interview with the IT teacher to discuss his observation notes.

4.1 Data Analysis Process

We qualitatively analyzed the collected data. *i.e.*, teacher's observations, interview, and the game log files, performing an inductive content analysis [11]. First, the descriptive data were anonymized, and the interesting phrases were coded. Then the coded results were further analyzed by 2 researchers separately to develop a coding schema each. Finally, the schemas were compared, evaluated and integrated to a final one with hyper-categories of codes. The collected game log files for each student were analyzed and coded in two axes: a) regarding student choices in each gameplay, aiming to identify their views or misconceptions and b) in cases students had played the game 3 times or more, we looked for possible patterns or changes in their choices between the gameplays, aiming to identify how their perception and attitude towards covid evolved through the game.

5 Preliminary Results and Discussion

The inductive content analysis of the qualitative data revealed some coding patterns regarding student perceptions, views, attitudes, and knowledge on how to act on the Covid-19 pandemic. From the initial analysis, four coding hyper-categories emerged: Personal/Social Views, Safety Understanding, Risk-Taking, and Strategy (Table 1).

According to the game logs analysis, most students lost the game due to the low value of the "Physical" (35%) game field, which means they neglected to make fitness-positive choices. The second most common reason to lose the game was high levels of "Covid Risk" (22%). This was detected especially by children who made choices according

Table 1. Coding categories that emerged from the data analysis

Coding hyper-category	Examples
Personal/social views	“I do not understand... why it is not a good choice to stay at home, using my PC for learning and gaming reasons?”, “But I do not want to go out, I am fine at home”
Safety understanding	“If I see a person who has covid, I must stay at home and test myself”. In-game logs: Make “low risk” choices several times
Risk-taking	“Maybe it was worth taking the risk of increasing covid_risk because I have to increase Fun”
Strategy	In the game logs: Make a repeated pattern of choices that balance the values e.g. Home→Workout→Exit home→Local store

to their daily routine before the pandemic, *e.g.* play football or go to a birthday party, without considering the possible risks for Covid-19. To keep Covid Risk low most students avoided fitness choices. This was also highlighted by the teacher who claimed that some students at first were hesitant or negative towards more social or fitness-related choices and made statements such as “*I prefer to stay at home, I can speak with my friends through the internet*” or “*I do not want to go out running or walking*”. All students achieved a higher score after playing the game several times, with a maximum score of 22 choices. Considering the sequence of the choices, in students’ first attempts we did not detect any specific patterns. On the contrary, the subsequent game logs revealed that students formed and repeated patterns of choices, especially the players who achieved a high score (code “Strategy” Table 1). Finally, according to the teacher, some students changed their initial views considering social, fitness and entertainment choices. As they claimed: “*Maybe, I can go out with my friends to swim and play by the sea, if I am careful*”, “*I think I should stay home for some time and then go out to take some air and then home again*”. Moreover, the game raised some critical topics for discussion that students had not considered before, such as “*where is it safer to go shopping during the pandemic?*” or “*how can I save money?*”.

6 Concluding Remarks

In this paper, we presented the design, implementation, and evaluation of a choice-driven simulation game called “Covid-19 Survivor”, which concerns a socio-scientific problem that significantly influences student lives [1, 2]. Since this was a pilot study with a reduced sample size and a short duration, the results cannot be generalized. Nevertheless, it provides insights into how simulation games like Covid-19 could enhance informed decision-making on crises that change children’s daily routines, such as a pandemic. Initial results demonstrate that students gradually developed strategies such as pattern recognition, prediction of the consequences and the risk of their actions, and analysis

of the interconnections and the rules of a system. Finally, the game raised important issues for discussion considering safe/unsafe choices and the importance of balancing their choices, *e.g.*, not neglect physical exercise. Future work will involve further data analysis and a new study with a larger sample of students who will also modify parts of the game in ChoiCo's design mode, such as available choices, consequence values, and ending conditions allowing us to compare their experiences and perceptions of the pandemic.

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